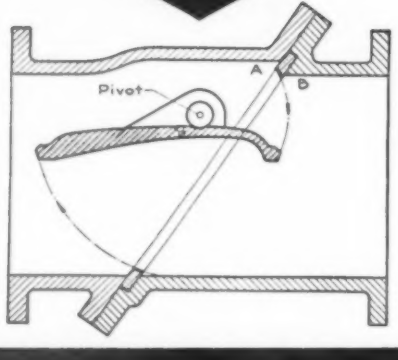
WATER & SEWAGE WORKS

ONE OF HARTFORD'S EMERGENCY TRUCKS

MAINTENANCE COSTS ARE LOWER

when you have *CUSHIONED CLOSING*

of—CHAPMAN CHECK (TILTING DISC) VALVES



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

That's right! Maintenance costs *are lower* with Chapman Check Valves . . lower because the balanced disc works *with the stream.* There's no slamming to cause destructive pipe line stresses and increase maintenance costs. Nor is there any rubbing on seats . . . the disc closes quickly and quietly with no sliding or wearing action.

Yet that's only half the story. Head losses are actually 65% to 80% lower than for conventional type check valves. And, when used on pump discharge lines, substantial power savings are possible.

Why not write today for engineering data and reports of tests.

THE CHAPMAN VALVE MFG. COMPANY
INDIAN ORCHARD, MASSACHUSETTS

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. September, 1949. Volume 96. Number 9. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second-class matter March 4, 1948, at the post office at Mount Morris, Illinois, under the Act of March 3, 1879. Executive and business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N.Y.

the "Great Gildersleeve"*

Commissioner Gildersleeve tells newly hired Meter Readerettes, "Your job is to make consumers drool . . . so they'll be thirsty . . . so they'll drink more water." He peers at the . . . well, at the efficient Pittsburgh water meter.

The girls eagerly lap up Gildy's instructions as he says, "Accuracy is our watchword and if you can't be accurate at least be on our side." His explanation is quite clear.

As the Commissioner concludes his instructions on the art of meter reading, the girls' interest and enthusiasm know no bounds. They're ready to read 'em and reap for dear old Summerfield.

Seriously—when you read Pittsburgh-Empire meters, you reap the greater revenue that results from in-built accuracy.

Handy Hypo for Healthful Water

Hypo-chlorination with HTH is the handy "do-it-today" way to disinfect reservoirs, basins, flumes . . . to sanitize filters, tanks and aqueducts. Convenient HTH permits on-the-spot sterilization of newly-laid water mains and other strategic points in your water supply system. And when a main breaks, a flood strikes or other emergencies arise, HTH is on the job in a jiffy—*if* you have it on hand. So order your supply today . . . and write for the 1948 edition of Mathieson's factful booklet: "Hypo-Chlorination of Water". Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

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Sanitation HTH . . . PH-Plus (Fused Alkali) . . . Liquid Chlorine . . . Chlorine Dioxide . . . Caustic Soda Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua . . . Dry Ice . . . Carbonic Gas Sodium Chlorite Products . . . Sodium Methylate

SANITATION HTH IS AVAILABLE IN CASES OF NINE HANDY 5-LB. CANS AND IN 100-LB. DRUMS.

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

Installation of Low Head Pumps

Is a contribution of value to designers of low-head pumping installations. Also, the revelations in this paper, based on first hand observations of the author, reveal weaknesses which may exist in present low-head pumping installations. This worthy contribution of "Do's and Don'ts" comes from the author of the series of articles which ran in this magazine on "Hydraulics for the Practical Plant Operator"—

R. W. ANGUS, M.E.
Consulting Engineer, Toronto, Ont.

Something New in Automatic Pumping

The application of "Magnetic-Drive" in sewage pumping is new. The first sewage plant to be equipped with the flexible intermediate "Magnetic-Drive" units between the motors and the low lift sewage pumps is that of Boston—the new Nut Island Treatment Plant. The second will be the Philadelphia installations. The article, to appear in our October issue, describes the principles and operation of this unique vari-speed electro-magnetic "fluid drive" unit, which produces automatic pump output to meet requirements or keep pace with changes in sewage flow with the minimum of pumping and pump control equipment. This article comes from—

H. J. MEEKER, Ass't. to Vice Pres.,
Worthington Pump & Mach. Corp., Harrison, N.J.

Corrosion Control

One of the most effective and practical papers that we have ever heard presented has never been put into form for publication. The author has promised us his discussion, based on a variety of experiences in corrosion control in connection with U. S. Army Camps. This contribution comes from—

DAN. PRODANOVICH, Eng'r.,
East Bay Utilities Distr., Oakland, Calif.

Sewage Treatment Plants for Small Housing Developments, Institutions, and Camps

Are often taken for granted when they should be given careful consideration. In this article, the design, operation, and maintenance of such plants are thoroughly discussed by—

R. W. SIMPSON, San. Engr.,
Gilbert Associates, Reading, Pa.

Big Spring Sells Its Sewage Plant Effluent for Industrial Use

Is an interesting story, revealing the value of sewage plant effluent to an important oil refinery for use as cooling water and boiler feed water. It tells of the profitable sale of more than 50 percent of the plant effluent for the past five years and the savings resulting to the purchaser of the effluent. The author—

H. W. WHITNEY,
City Manager, Big Spring, Texas.

Metallurgical Plant Wastes and Their Treatment

Is a topic receiving increasing attention of sanitary and industrial engineers. This article presents an approach to and the solution of such problems. The author is—

HARRY D. UNWIN, Engr.,
Albert Kahn Associates, Detroit, Mich.

Floc-Clarifier Handles Sewage and Slaughter House Waste

According to an article which describes the revision in the plant at Huron, S. Dak. Faced with a problem of increased domestic sewage and slaughter-house waste load the plant was reconstructed according to the designs of the consulting engineer and author of this paper—

E. H. DUNMIRE,
Cons. Engr., Lincoln, Neb.

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VOL. 96, NO. 9

CONTENTS

SEPTEMBER, 1949

The Chemistry of Water Treatment, Part 5 325
By A. P. Black
University of Florida

Emergency Procedure 330
By S. L. Rogers
Hartford, Connecticut

Impressions of the Chicago Conference—June, 1949 332
By N. S. F. Winter
Halifax, England

A.W.W.A. Purification Division 333
As reported by H. A. Faber
Editorial Associate

"Bob" Simms Honored 338

Corrosion Control by Threshold Treatment 339
By J. H. White
Boston, Massachusetts

Report on General Sessions of A.W.W.A. at Chicago 341

Ft. Worth, Tex., Makes Quick Comeback from Flood Damage 350

In Seattle All Is Serene 351
By Wm. C. Morse
Seattle, Washington

Oxidation-Reduction Potentials in Sewage Treatment 352
By J. W. Hood and G. A. Rohlich
Ridgewood, New Jersey Univ. of Wisconsin

Preconditioning and Digestion of Sewage Sludge, Part 4 355
By T. R. Haseltine
Pittsburgh, Pennsylvania

Alabama Water & Sewage Assn. 4th Annual Meeting 359

Exploded Sewer Quickly Repaired With Corrugated Pipe 362
By T. B. Ray
New Rochelle, New York

Four Series of Weather Cycles 363
By H. P. Gillette
San Marino, California

Meetings Scheduled 84A

"Here and There" with Doc Symons 86A

Manufacturers' and Equipment News 104A

Literature and Catalog Reviews 112A

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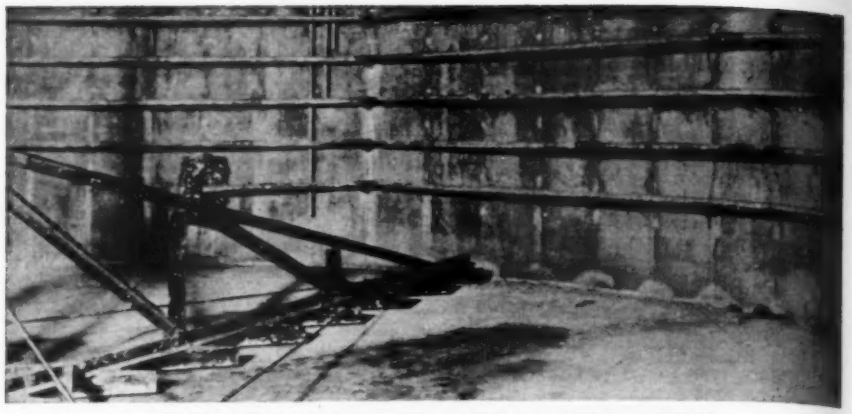
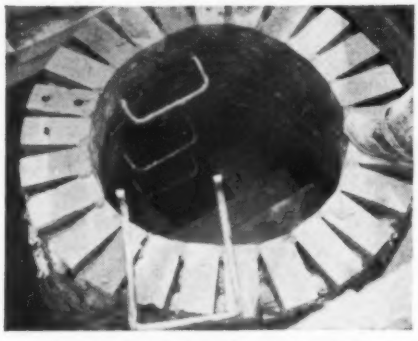
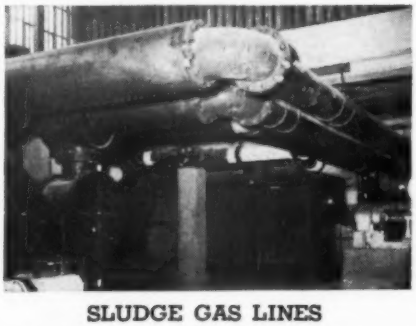


DIGESTER COILS AND STIRRING MECHANISM

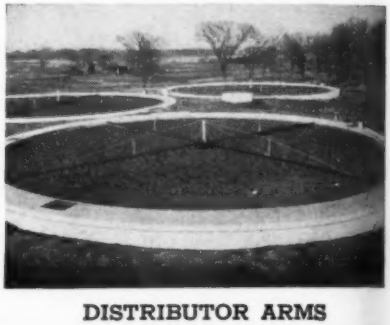


MANHOLE LADDER STEPS

VENTILATING DUCTS



SLUDGE GAS LINES



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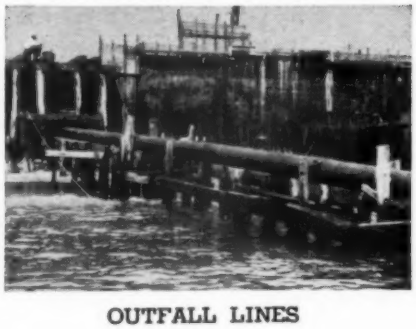
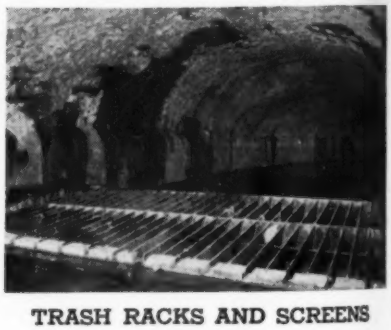


OUTFALL LINES



TRASH RACKS AND SCREENS

The leading question in the mind of every thoughtful man concerned with sewage treatment plant construction is the minimizing of future maintenance. The leading answer is Byers Wrought Iron.

The best indication of the superior service qualities of wrought iron is found in its almost universal use for the hottest spots in treatment plants. Digestion coils, for instance, represent one of the most punishing services of all. The naturally high corrosiveness of the sewage is increased by elevated temperatures. Where engineers have had a chance to observe and compare . . . you'll generally find wrought iron on the job.

Stirring mechanisms face the same conditions. In one western plant, the original mechanism, made of low-first-cost materials, lasted only a year. Then wrought iron was used . . . and at last report had been seven years on the job, with no sign of failure.

In Manhole ladder steps, the trend is definitely toward wrought iron; many municipalities have already standardized on the material. Engineers, bothered with frequent failures of steps made of other metals, remembered that when wrought iron was used there had been no difficulties . . . and acted accordingly.

Call the roll of the most corrosive services in the treatment plant, and you'll have a good check list of the places where wrought iron is solving maintenance problems to the complete satisfaction of users. If you would like to review the use that modern plants are making of wrought iron, and to see some of the performance records that support the choice, ask for our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations."

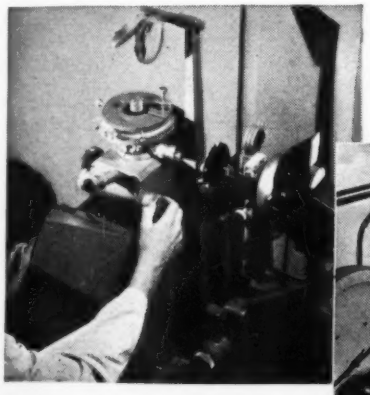
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

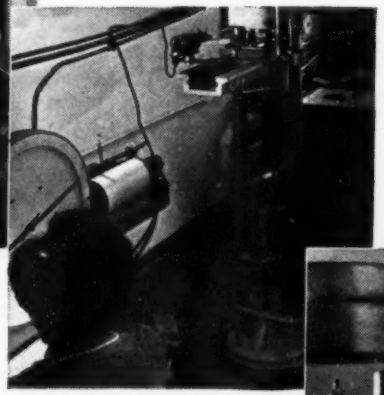
Announcing a New Research Laboratory and Foundry —

The Research Foundry is an integral part of the research laboratory and is housed in the same building. It is equipped with the most modern facilities for metallurgical research and development. Cut shows an experimental centrifugal casting operation.

To implement the expanded activities of our Research and Development Department in product and process research, we have built and equipped a new Research Laboratory and Foundry at Burlington where our General Offices and our Burlington plant are located. One of the largest and finest in the cast iron pressure pipe industry, its completion and recent dedication signalizes the 50th Anniversary of the founding of our Company.

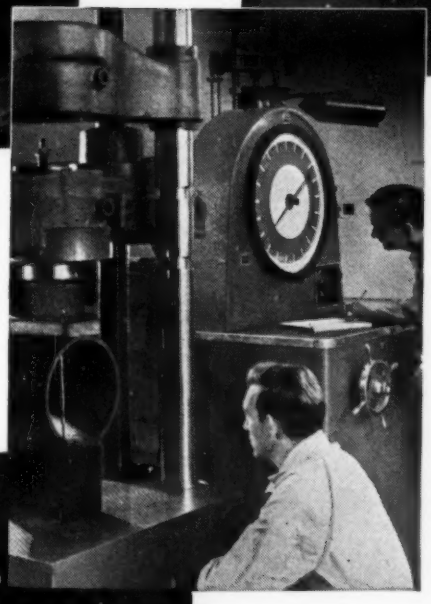


The Metallographic Laboratory is devoted to the study of metal structure. Cut shows a Projection Microscope of the latest design. This precision instrument magnifies up to 4400 diameters.



Talbot Strip Tests—an acceptance test for centrifugally-cast pipe—are also conducted in the Physical Laboratory. A strip cut from pipe is under test and at left is the mechanized recorder which shows load and deflection.

The Chemical Laboratory is a service laboratory for research and development projects, and performs qualitative and quantitative analyses of a wide variety of materials. It also establishes standard analytical procedures for the laboratories at our several plants.



In the Physical Laboratory a 200,000 lb. universal testing machine of the most modern type is used for the Ring Crushing Test.

U.S. Pipe & Foundry Co.

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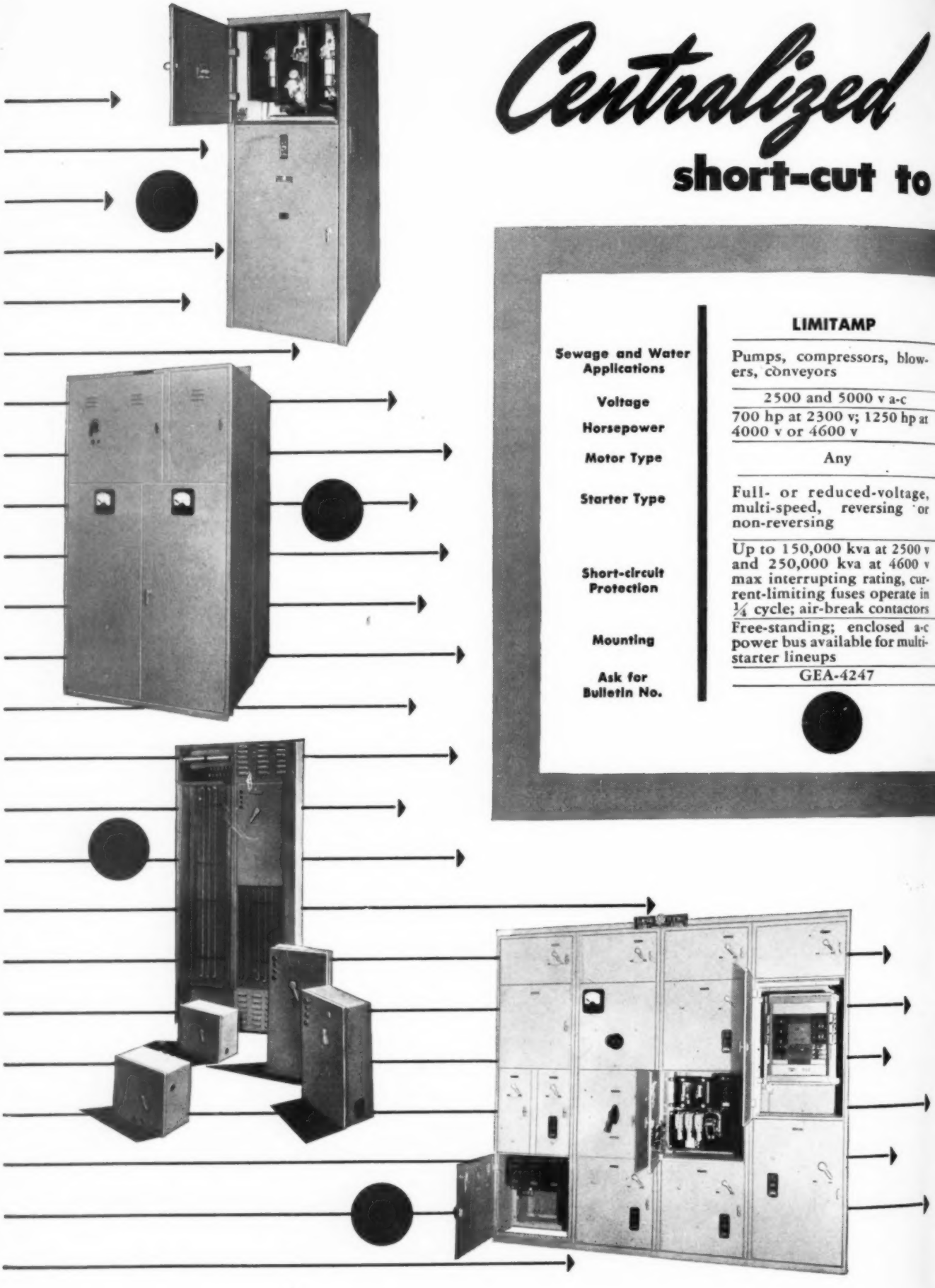

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Sewage and Water Applications	Pumps, compressors, blowers, conveyors
Voltage	2500 and 5000 v a-c
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350 hp d-c, 800 hp a-c max	Up to 100 hp at 440 v	Up to 400 hp at 440 v; or 200 hp at 220 v
Any	Squirrel-cage induction; multi-speed	Any
Full- or reduced-voltage, multi-speed reversing or non-reversing	Combination starters, full-voltage or reactor reduced-voltage, reversing, non-reversing or two-speed	All kinds, including magnetic and electronic
Up to 25,000 or 50,000 amp short-circuit interrupting rating, starters with draw-out air circuit breakers	Up to 25,000 amp interrupting rating; combination starters with air circuit breakers in isolated compartments	Up to 50,000 amp interrupting rating; combination starters with air circuit breakers or fused switches in isolated compartments
Free-standing; enclosed a-c power bus available for multi-starter lineups	Wired or unwired, accessible from front	Free-standing, completely wired, accessible front and rear
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One Of The Above General Electric packaged control equipments can be tailored from standard parts to fill any sewage- or water-plant need. Each is completely metal-enclosed, factory-assembled and tested, and shipped ready to install. To save you installation time and expense, all bus connections, panel wiring, and interconnections can be made at the factory . . . just set the unit in place and hook up incoming and outgoing leads.

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Your consulting engineer or General Electric representative will tell you more about these equipments and help you plan your entire electrical layout. Consult him early, so that you can profit by co-ordinated planning . . . thereby simplifying engineering, buying, construction and installation. Apparatus Dept., General Electric Co., Schenectady, N. Y.

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Fourteen years earlier, in 1840, Detroit laid her first 8-inch cast iron pipe and 97.9% of all the 8-inch cast iron pipe laid during the past 109 years is still in service. A portion of a 10-inch cast iron transmission line laid in 1838 is still in service.

Detroit is one of the cities included in the survey of "Survival and Retirement Experience with Water Works Facilities," including cast iron water mains, conducted under the auspices of the American Water Works Association, the New England Water Works Association and the Institute of Water Supply Utilities. The recently published report of the findings of the survey shows that 96% of all 6-inch and larger cast iron water mains ever laid in 25 representative cities are still in service.

Detroit's experience with cast iron water mains, therefore, while remarkable, is not exceptional.

We shall be glad to send on request a copy of our brochure "Survival and Retirement Experience with Cast Iron Water Mains," reprinted by permission. Address Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 122 South Michigan Avenue, Chicago 3, Illinois.

96%

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There's good reason for their confidence, because Lincoln, Nebraska is protected by Mathews Modernized Hydrants—and that means safety *plus*.

These great hydrants are the last word in simplicity and serviceability. Water cannot reach the operating thread—no risk of ice jamming it—no risk of deterioration from rust or sediment. The revolving nut is shielded against rain, snow and dust. All working parts are contained in a removable barrel which can be replaced in a jiffy if the hydrant is broken by a truck. And the damaged hydrant cannot leak, because the main valve opens *against* water pressure.

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THE MATHEWS FIREMEN SAY

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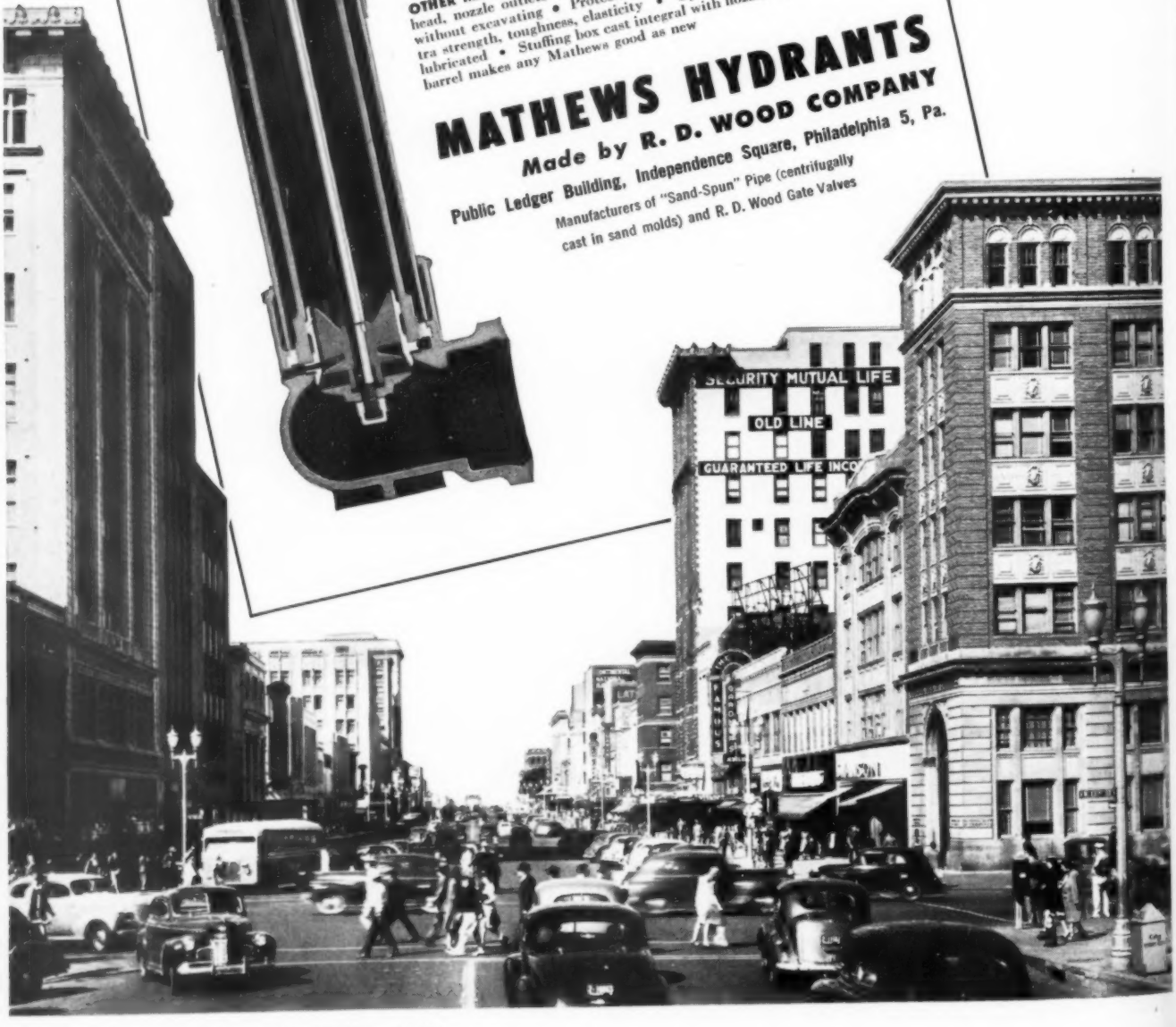

A COMPLETE LINE

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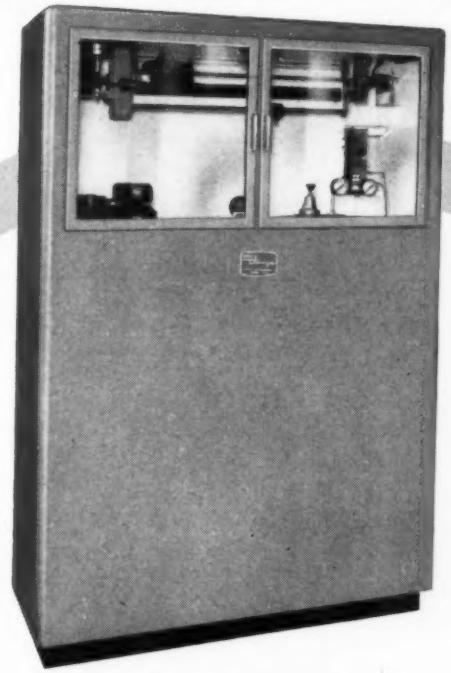

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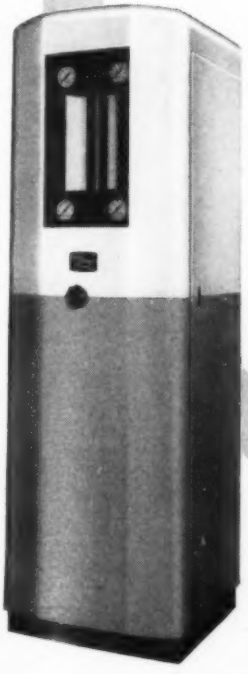
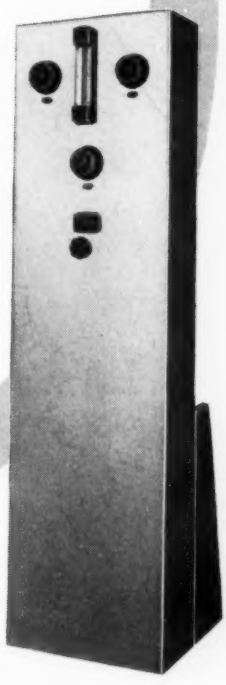


VOLUMETRIC
Model CVS

VOLUMETRIC
Model DVS



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BUILDERS PROVIDENCE
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FOR MUNICIPAL WATER STORAGE REQUIREMENTS

PITTSBURGH • DES MOINES

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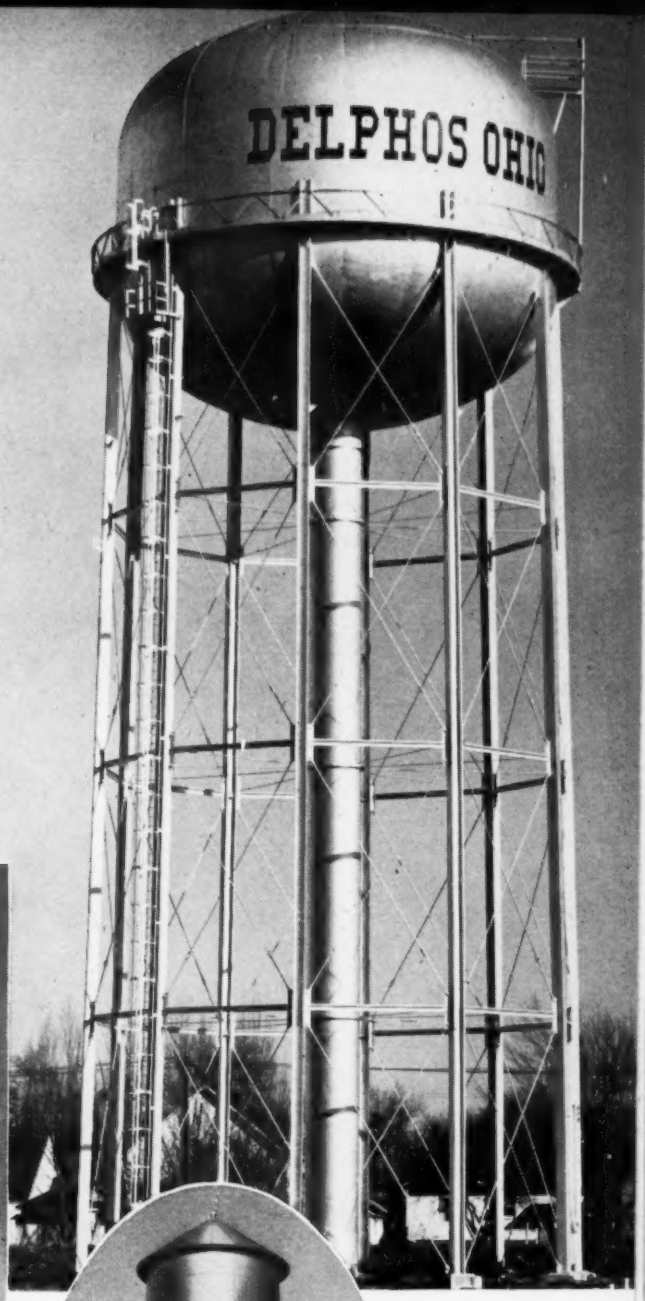

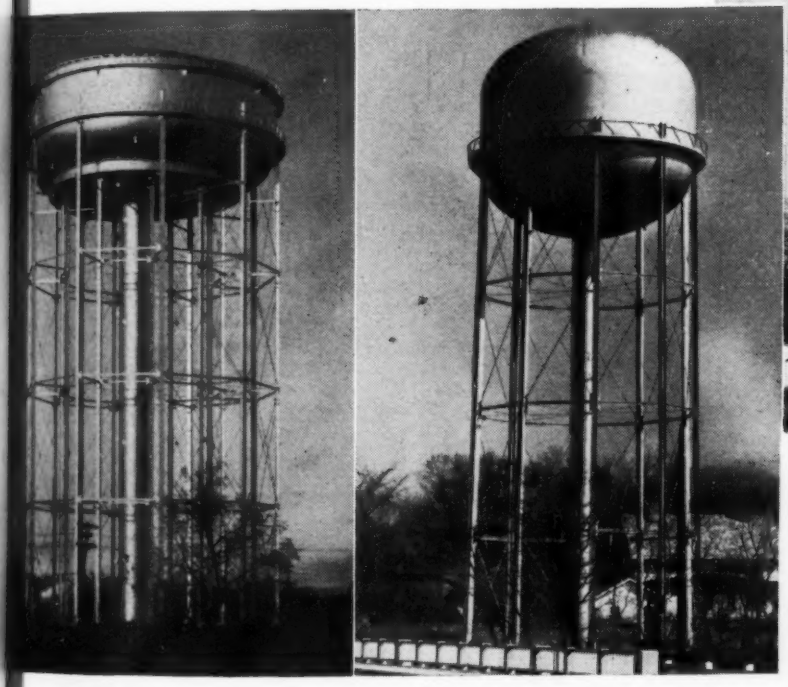

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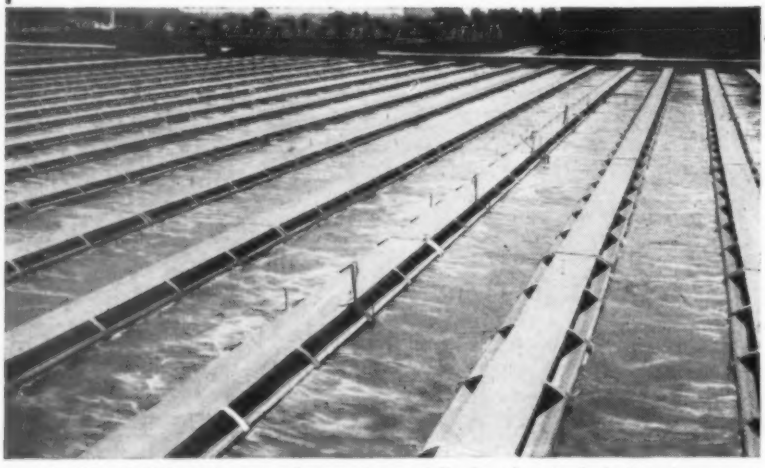
Performance in World's Largest Sewage Treatment Plant...

...leads to extended use of Everdur Electrical Conduit



Everdur Electrical Conduit serves the aeration and final settling tanks in bringing power from the operating galleries to the sluice gates of the control centers, and from these centers to the operating mechanism on the center pier of each tank.

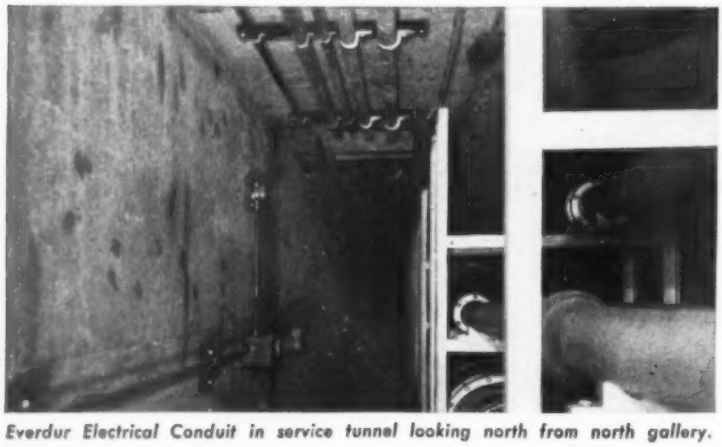
General view of Southwest Treatment Works, Chicago, world's largest activated sludge sewage treatment plant.

WHEN Chicago's Southwest Sewage Treatment Plant was built twelve years ago, it utilized 14 miles of Everdur* Electrical Conduit, in sizes from ¾" to 2½". Conduit of Everdur Metal was selected because of its high physical properties and excellent resistance to many corroding agents.

More and more Everdur Conduit has gone into this plant, as its 1939 capacity of 400 m.g.d. had been expanded to 1,000 m.g.d. at mid-1948. Further expansion will take place over the next 5 years. Considerable Everdur Conduit is specified in several new contracts awarded to the Northern States Electric Company, Chicago.

For detailed information on Everdur Copper-Silicon Alloys in Sewage and Water Works service, write for Publications E-11 and E-5. 48188

*Reg. U.S. Pat. Off.



Everdur Electrical Conduit in service tunnel looking north from north gallery.

ANACONDA
from mine to consumer

Everdur

COPPER-SILICON ALLOYS

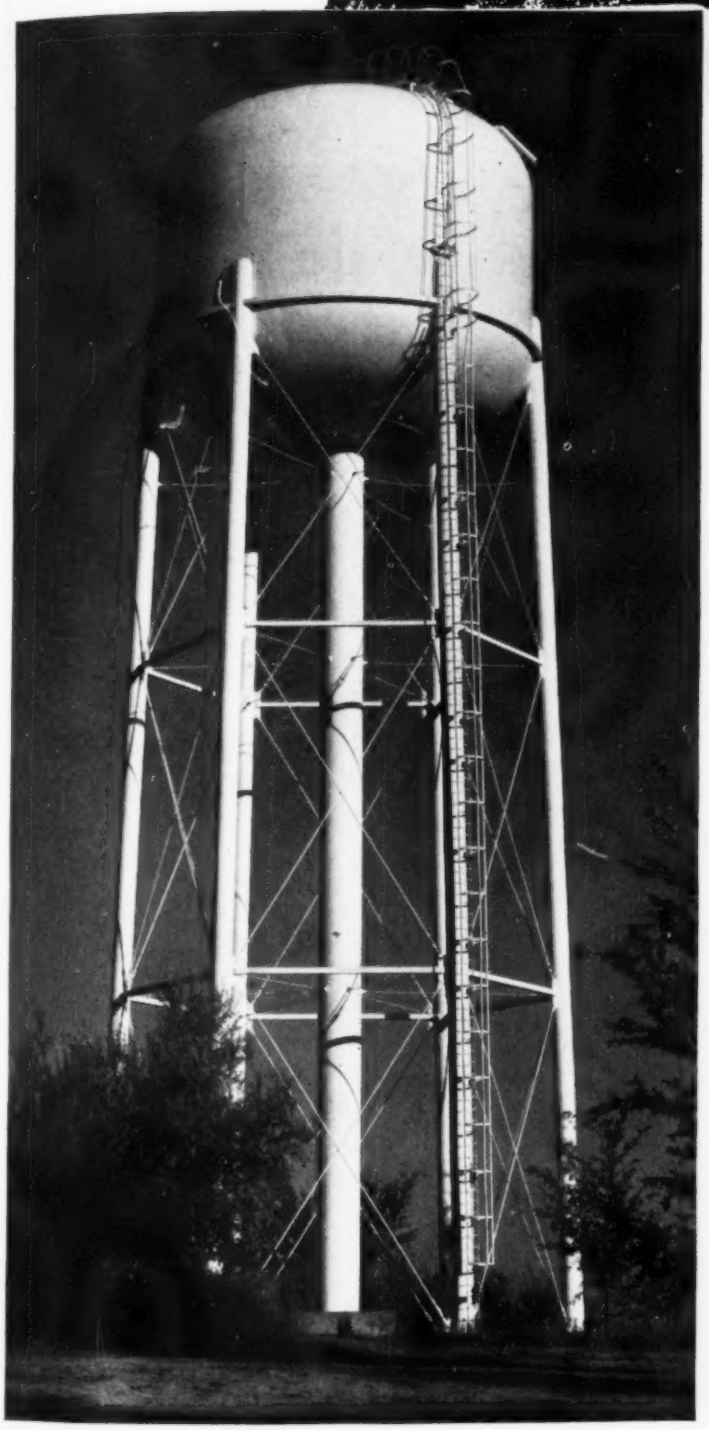
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

City of *Council Bluffs*



adds new 200,000-gallon HORTON Elevated Tank

To increase the storage capacity in the high service section of its water works system, the City of Council Bluffs, Iowa, recently installed the 200,000-gallon ellipsoidal-bottom Horton tank shown at the left. It will supplement an existing 175,000-gallon tank in providing gravity water pressure from elevated storage for the eastern edge of the distribution system.

Gravity water pressure supplied by an elevated tank improves the service provided by a water system in several ways. It helps to maintain uniform pressure in the mains; reduces pumping costs; helps to meet peak loads, and usually lowers fire insurance rates on all property in the city.

Horton ellipsoidal-bottom tanks are made in standard capacities from 15,000 to 500,000 gallons. Installations for municipal service are built in accordance with the American Water Works Association specifications.

Engineering Data on Council Bluffs Water System

Source of Water—Missouri River

Storage Capacity—
- 4,000,000 gals. (reservoirs for center of system)
- 375,000 gals. (elevated storage for eastern edge of system)

Domestic Customers—10,700

Industrial Customers—88

Length of Distribution Mains—145 miles

Area Served—16.3 sq. mi.

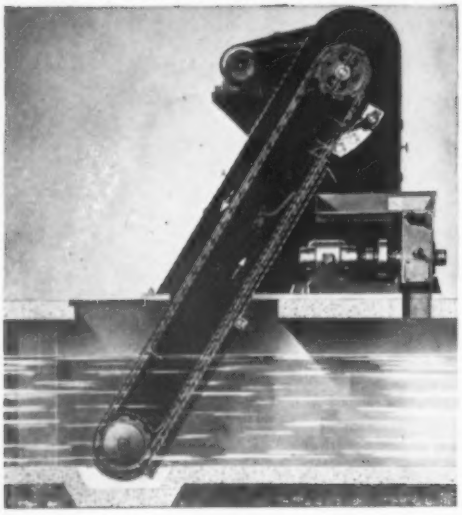
Maximum Consumption Rate—7 mgd.

Minimum Consumption Rate—4 mgd.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3 ..... 2181 Healey Building
Birmingham 1 ..... 1586 North Fiftieth Street
Boston 10 ..... 1048—201 Devonshire Street
Chicago 4 ..... 2198 McCormick Building
Cleveland 15 ..... 2262 Guildhall Building
Detroit 26 ..... 1551 Lafayette Building
Houston 2 ..... 2115 National Standard Building
Havana ..... 402 Abreu Building
Los Angeles 14 ..... 1555 General Petroleum Building
New York 6 ..... 3390—165 Broadway Building
Philadelphia 3 ..... 1644—1700 Walnut Street Building
Salt Lake City 1 ..... 1550 First Security Bank Building
San Francisco 11 ..... 1283—22 Battery Street Building
Seattle 1 ..... 1350 Henry Building
Tulsa 3 ..... 1646 Hunt Building

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

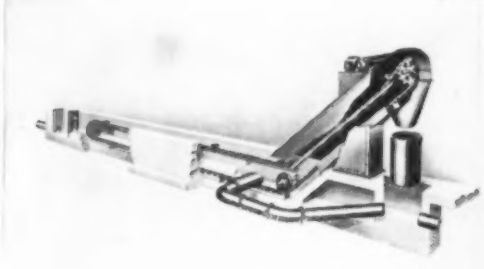


REX MECHANICALLY CLEANED BAR SCREENS AND TRITURATORS are neat, streamlined units that provide an efficient means of removing large solids from liquids and reducing them in size. Reduced material is returned into the sewage flow for quick and efficient handling in settling tanks and digesters.

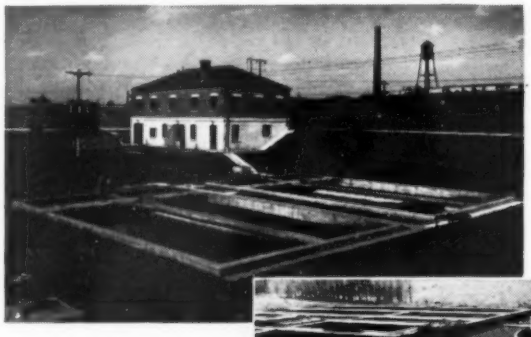
It's a Matter of Record...

. . . and in plant after plant, the records show that Rex Sanitation and Process Equipment provides unequaled efficiency . . . sets the standards for economical, long-life operation

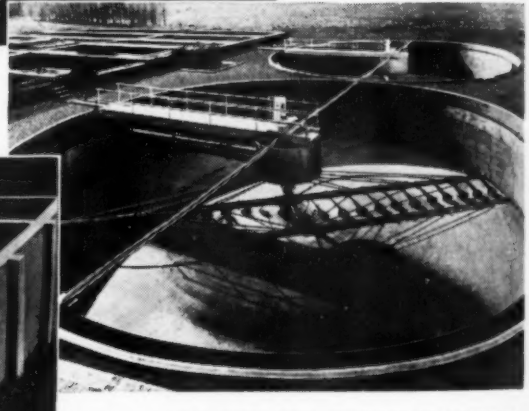
Whether it's a large plant or small, a look at the figures will convince you that Rex Equipment is right for your operation . . . primary or complete treatment . . . domestic or industrial waste. Specially trained Rex Sanitation Engineers will be happy to assist you with your individual problems. For all the facts, write for your copy of Bulletin No. 48-41. Chain Belt Company, 1610 West Bruce Street, Milwaukee 4, Wis.



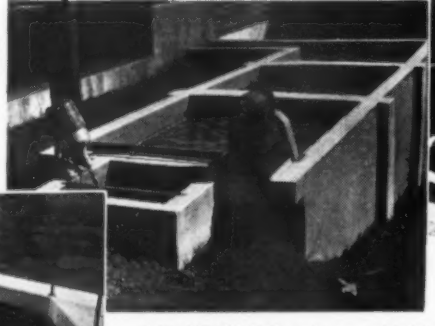
REX GRIT EQUIPMENT with its exclusive recirculating principle, effectively separates and removes inorganic solids from liquids. No grit washer is required. Rugged construction assures long, economical service.



REX CONVEYOR SLUDGE COLLECTORS combine the well-known advantages of the rectangular settling tank with a rugged and efficient form of sludge removal mechanism. Whether handling primary sludge or light flocculent solids, their performance is efficient and economical.



REX SLO-MIXERS AND FLASH MIXERS assure rapid disbursement of chemical throughout the liquid, followed by a gentle, multi-stage slow mixing for optimum floc formation. Rex Slo-Mixers eliminate short-circuiting and effect savings in chemicals.



REX VERTI-FLO delivers a highly clarified effluent with an extremely short detention period. It provides maximum tank capacity for any desired tank size and maximum practical weir length. The combination of large weir length and low vertical velocities assures a clearer effluent, far greater capacity at minimum cost.

REX TOW-BRO SLUDGE COLLECTORS assure accurate control of sludge removal over a wide range of withdrawal rates through their exclusive design. Sludge is removed immediately on contact instead of the usual plowing or scraping. Greater sludge concentration, greater operating flexibility, and a clearer effluent are a few of the many advantages.

CHAIN BELT REX COMPANY

SANITATION EQUIPMENT

for primary and secondary settling tanks

Jeffrey Collectors—designed for rectangular shaped settling tanks — simplest and most efficient type of sedimentation device.

Large Carrying Capacity — permits intermittent operation.

Stable Conditions of Flow—resulting from proper baffling of influent and correct location of effluent troughs.

Considerable Power Saving—one-half revolution of conveyor once or twice daily sufficient to remove all settled sludge — thicker sludge and clearer effluent.

Positive Movement of Scum — to effluent end of tank for removal by Scum Removers.

These Collectors — for small, medium or large tanks—have been installed in many plants—all same general, well-proved design. Besides we make Bar Screens, Grit Washers and Collectors, Scum Removers, Chemical Feeders, Grinders, Sludge Elevators, Flocculation Equipment, etc.

A competent Sanitary Engineer, well versed in the treatment of water and sewage by mechanical means, will be glad to make recommendations.

JEFFREY

ESTABLISHED 1877

JM

SALES OFFICES IN PRINCIPAL CITIES

THE JEFFREY MANUFACTURING COMPANY 996 NORTH FOURTH STREET, COLUMBUS, OHIO

ACCELATOR® WINS AGAIN!

INFILCO WATER CONDITIONING PLANT, GAINESVILLE, FLORIDA

INFILCO EQUIPMENT NOW GIVES GAINESVILLE, FLORIDA, 5,000,000 G.P.D. OF FINEST QUALITY WATER!

AN abundance of soft, pure, crystal-clear water now serves the citizens of Gainesville, Florida. It is produced quickly, efficiently and at low cost by an INFILCO Water Conditioning Plant turned into operation in December. An ACCELATOR is the outstanding feature of this modern installation. It softens and clarifies 5,000,000 G.P.D., delivering a uniform water of highest quality, free of chlorine taste and odor!

ACCELATORS can effect up to 80% *savings in space!* Mixing, coagulating, settling and sludge removal . . *all* these steps are replaced in ONE COMPACT UNIT. They give simpler operation, faster chemical reaction, higher ratings, and an exclusive slurry recirculating feature which produces better, clearer water in less time. Over 1100 ACCELATOR installations from coast-to-coast are now softening or clarifying ONE BILLION gallons of water every day. Send for complete information, today!

SEND FOR THIS NEW 28-PAGE ACCELATOR BULLETIN NO. 1825

Here's a complete 28-page bulletin illustrating and describing all phases of ACCELATOR operation. Filled from full color cover to cover with installation pictures, charts, graphs and tables. Just off press, a copy is available free to all concerned with water conditioning and waste treatment problems. Write for your copy today!

INFILCO

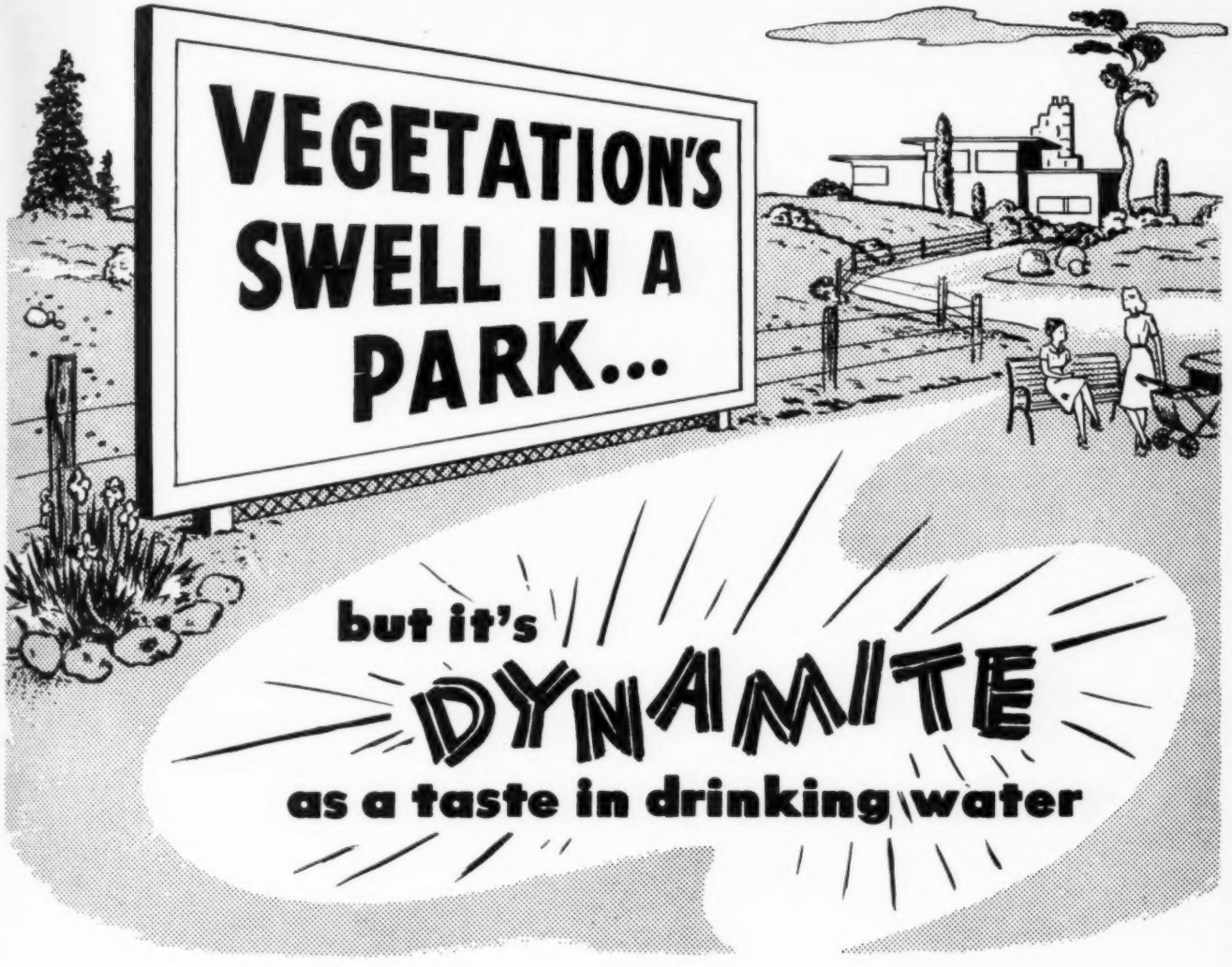
• BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894 •

INFILCO INC.

GENERAL OFFICES: 325 WEST 25th PLACE • CHICAGO 16, ILLINOIS

SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT



Don't jeopardize your hard earned consumer good-will by letting vile tastes and odors slip into your water supply. Aqua Nuchar Activated Carbon is the quickest, most economical water purification method to control tastes and odors originating from decaying vegetation, algae and industrial trade wastes. It has been used successfully by over 1200 communities to remove odors characterized as vegetable, earthy, woody, bitter, aromatic, fishy, marshy, swampy and chlorine.

Aqua Nuchar is specially manufactured for use in water purification. For nearly twenty years, our Research Staff has carried on tests in our laboratories and in the field to determine the correct combination of activated carbon properties to give optimum taste and odor control. Aqua Nuchar now has these special qualities: superior activation, increased porosity, greater dispersion and better suspendability. Because of its extreme fineness, it disperses more quickly throughout the entire body of water and remains in suspension a longer period of time; the exceptionally porous carbon particles have a greater opportunity to contact taste and odor bodies in the water to remove them by adsorption.

Write to our nearest office and arrange to have our Technical Service Department study your taste and odor problems.

INSURES PALATABLE NUCHAR DRINKING WATER

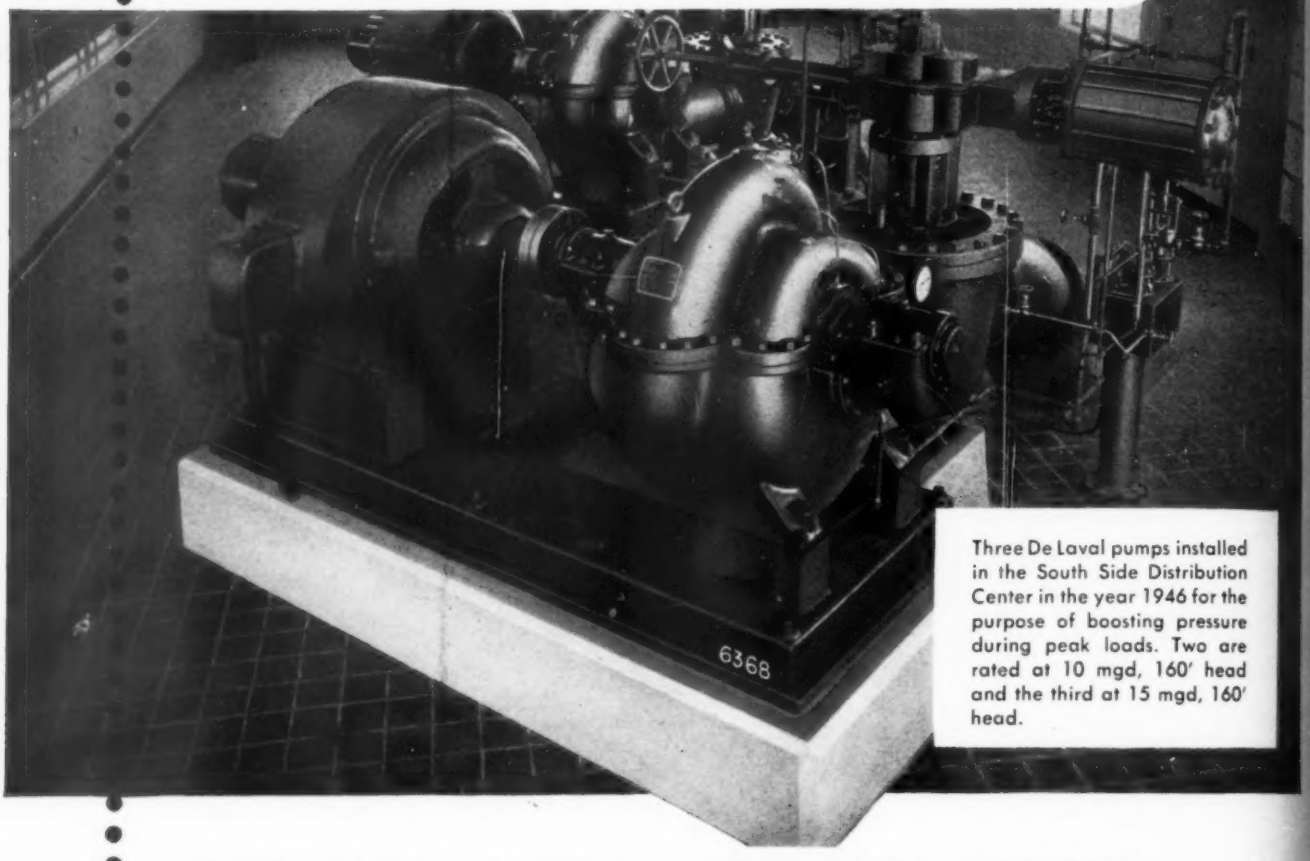
industrial CHEMICAL SALES

division west virginia pulp and paper company

NEW YORK CENTRAL BLDG.	PURE OIL BLDG.	PUBLIC LEDGER BLDG.	LEADER BLDG.
230 PARK AVENUE	35 E. WACKER DRIVE	INDEPENDENCE SQUARE	526 SUPERIOR AVE., N.W.
NEW YORK 17, N. Y.	CHICAGO 1, ILLINOIS	PHILADELPHIA 6, PA.	CLEVELAND 14, OHIO

OTHER PRODUCTS: *Snow Top Precipitated Calcium Carbonate* • *Nuchar Activated Carbons* • *Liqro Crude Tall Oil* • *Indusoil Distilled Tall Oil* *Tallene Tall Oil Pitch* • *Tallex Abietic Acid* • *Sulfate Wood Turpentine* • *Alpha Pinene* • *Beta Pinene* • *Polycel Cellulose Fibers* • *Indulin (lignin)*

FOR THE 7th TIME



Three De Laval pumps installed in the South Side Distribution Center in the year 1946 for the purpose of boosting pressure during peak loads. Two are rated at 10 mgd, 160' head and the third at 15 mgd, 160' head.

FLINT WILL INSTALL DE LAVAL PUMPS

to meet increased water demands

Seven times in a row . . . 1918, 1921, 1923, 1924, 1930, 1946, and now in 1949 the City of Flint, Michigan will install De Laval pumps to satisfy an ever inceasing demand for water. Four low lift and two high lift pumps will be installed in Pumping Station No. 3 later this year and they will give the City of Flint a total capacity of 352 mgd . . . all handled by De Laval pumps.

Here, as in over 78 per cent of America's cities, De Laval pumps have insured complete dependability and high sustained efficiency, year after year. When you are ready to install additional pumping capacity, specify DE LAVAL.

SEND FOR CATALOG 10-8-WS

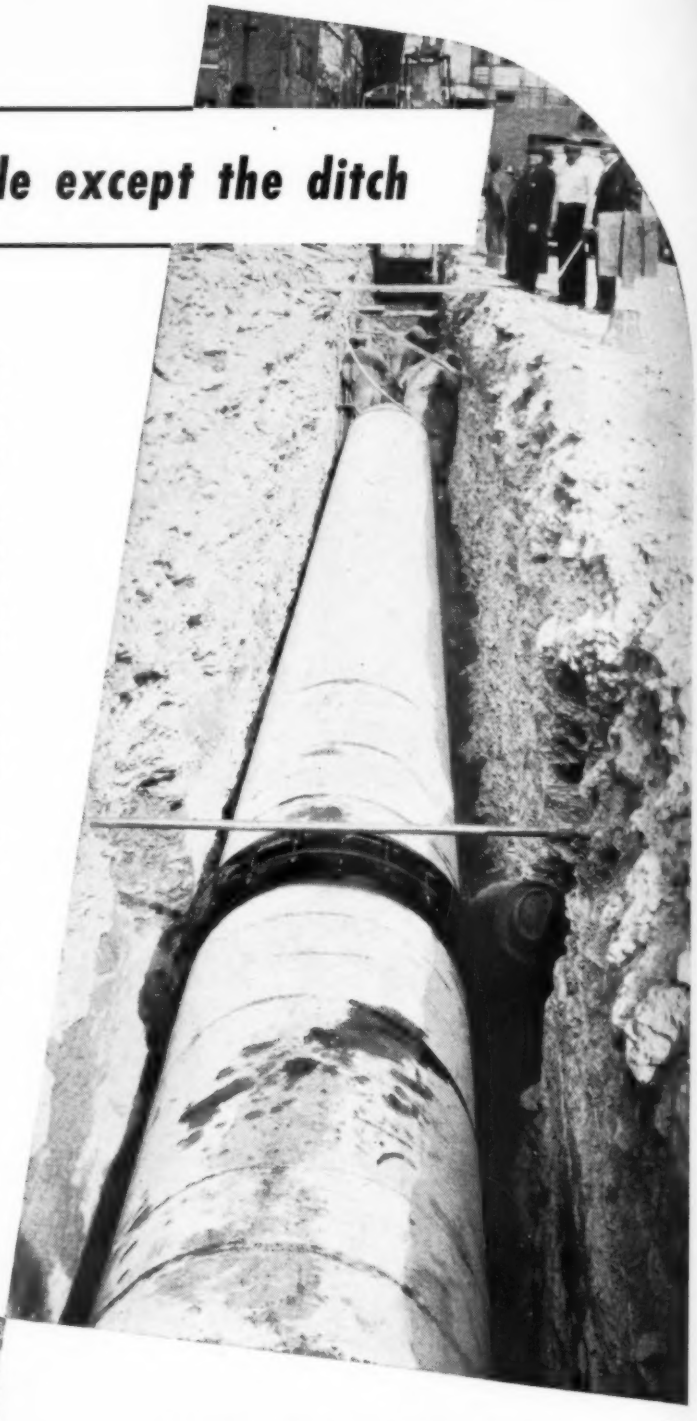
DE LAVAL

DE LAVAL STEAM TURBINE CO., TRENTON 2, N.J.

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

MORE PUMP
POMONA!
Any way you measure it, a Fairbanks-Morse Pomona gives you more for your pump dollar . . . in performance . . . in efficiency . . . in low-cost operation and maintenance.
Combine such features as true water lubrication . . . trouble-free open impellers . . . smooth, quiet revolvable rubber shaft bearings . . . simple "at the surface" capacity adjustment . . . plus the Fairbanks-Morse reputation for unsurpassed quality . . . and it's easy to see why.
Your Fairbanks-Morse Pomona Pump Distributor or branch pump engineer will be happy to give you the complete story on the pump that gives you more . . . *Pomona!* Fairbanks, Morse & Co., Chicago 5, Ill.
FAIRBANKS-MORSE
A name worth remembering
DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS
GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES
FARM EQUIPMENT • MAGNETOS

Everything factory-made except the ditch



Many a question mark in water line construction is eliminated when you install a coupled steel water line. You use plain-end steel pipe just as it comes from the mill—assemble it with Dresser Couplings just as they come from the factory.

Both the pipe and the pipe joint are factory-made under ideal manufacturing conditions. There's no field fabrication, nothing to go wrong. Any workman can make permanent, flexible-tight joints every single time with Dressers, and the only tool needed is a wrench.

You get the full advantage of modern, glass-smooth linings, too. Dresser Couplings fit *outside* the pipe. There's no heat to damage the lining, no need for workmen to go inside the pipe.

And, for the life of the line, Dressers provide flexibility at every joint—a cushion against vibration, expansion, contraction and other stresses.

For extra safety, easy installation and permanent dependability, specify a Dresser-Coupled steel line. *Write for Dresser's "Report of Coupled Steel Water Lines".*

SIMPLE • FAST • FLEXIBLE • PERMANENT

Even in cramped quarters, Dresser Style 38 Couplings make permanently tight, flexible joints every time.

PARTIAL LIST OF CITIES USING DRESSER-COUPLED STEEL LINES

Cleveland, Ohio	Boston, Mass.	Newark, N. J.
Philadelphia, Pa.	Syracuse, N. Y.	Savannah, Ga.
Detroit, Mich.	Washington, D. C.	Denver, Colo.
Springfield, Mass.	Spokane, Wash.	New York, N. Y.

DRESSER

"FLEXIBLE-TIGHT" COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries)—In Texas: 1121 Rothwell St., Houston —In Canada: Dresser Mfg. Co., Ltd., 629 Adelaide St., W., Toronto, Ont.—Sales Offices: New York, Chicago, Houston, San Francisco.

Chemicals you live by

THE *BACK-TO-NATURE* MOVEMENT

The increasing emphasis in every state and community upon restoration of our natural water sources is building public interest to a point which is sure to increase demands for water treatment.

You can turn to DIAMOND ALKALI for expert assistance in the use of chemicals and for fast delivery. DIAMOND has three plants producing chlorine, so located as to supply all the nation conveniently; a centrally located plant for furnishing Soda Ash and Alkali Specialties for water softening and equipment protection; and six plants producing DIAMOND Standard Silicates for settling impurities and clarifying water.

DIAMOND is ready now, to supply chemicals—or work with you in preparing for the use of chemicals on new projects.

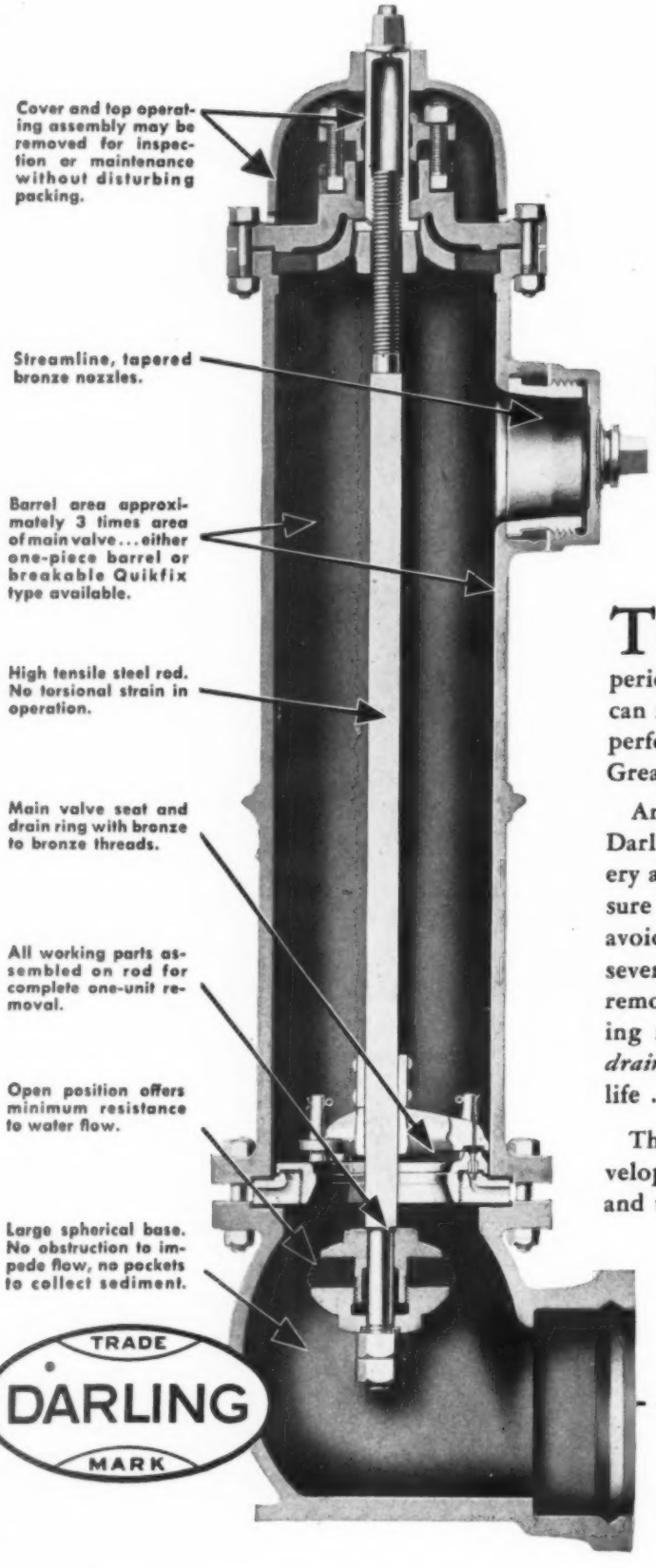
DIAMOND SALES OFFICES: Boston, New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Wichita, Oklahoma City and Houston. Also representatives in other principal cities.

DIAMOND CHLORINE

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

Peace of mind sums it up!


Cover and top operating assembly may be removed for inspection or maintenance without disturbing packing.
Streamline, tapered bronze nozzles.
Barrel area approximately 3 times area of main valve... either one-piece barrel or breakable Quikfix type available.
High tensile steel rod. No torsional strain in operation.
Main valve seat and drain ring with bronze to bronze threads.
All working parts assembled on rod for complete one-unit removal.
Open position offers minimum resistance to water flow.
Large spherical base. No obstruction to impede flow, no pockets to collect sediment.

THIS man shares responsibility in his town for fire-fighting efficiency and operating cost. Experience has shown him that on both counts he can rely on Darling hydrants for the finest kind of performance . . . year around, year in, year out! Greater peace of mind is another way of putting it.

Are you familiar with all the *advanced* features of Darling hydrants? These include peak water delivery at the nozzles with no perceptible loss of pressure . . . positive, automatic flushing of drains to avoid freeze-ups . . . prevention of flooding despite severe traffic damage . . . fast, simplified, *one-man* removal and inspection of *all* working parts including main valve, *main valve seat,* drain valve and *drain valve seats* . . . unsurpassed ruggedness and life . . . modern, good-looking exterior.

These are only a few of the Darling features developed to ease your mind on hydrant performance, and to ease your budget on over-all cost! Catalog 17M describes *all* the features in detail, tells all about Darling hydrants for every known service both normal and unusual. We'll be happy to send you a copy.

TRADE DARLING MARK

DARLING
VALVE & MANUFACTURING CO.
Williamsport 11, Pa.

Save...

PROMPT SHIPMENT

Time, Money and Labor in making pipe joints

... The only field equipment necessary to make a Universal Cast Iron Pipe Bolted Joint is a Ratchet Wrench.

by using

UNIVERSAL*
CAST IRON PIPE

(PIPE and JOINT are ONE)

Outstanding Advantages:

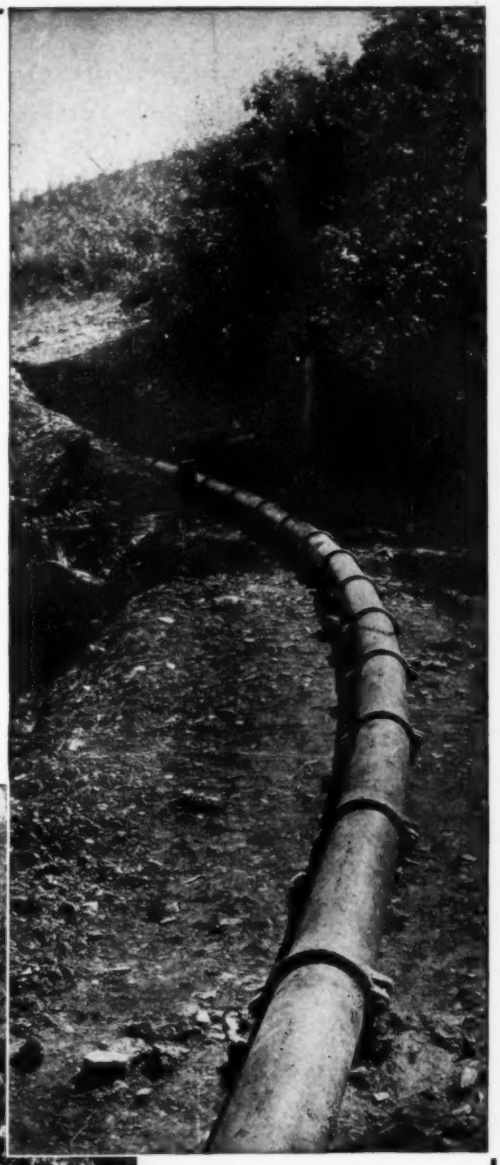
1. *No calking or pouring of lead or lead substitutes. No gaskets used.*
2. No bell holes to dig. Can be laid in a narrow trench. Cost of wide trenching is eliminated.
3. *Can be laid with SPEED. Easier and cheaper to install because only two bolts need to be inserted in the lugs, tightened with a ratchet wrench (the only tool needed), and the completed joint is made in a few minutes. Experienced workmen are not needed.*
4. Nothing to deteriorate; nothing to work loose; no leakage; no maintenance cost.
5. Flexibility: Universal pipe is very flexible. It withstands expansion, contraction, unequal settlement, vibration and shock, and electrolysis. Many curves are laid with straight lengths and do not need special fittings.
6. *Universal pipe can be laid on rocky soil, under water and in sub-zero weather.*

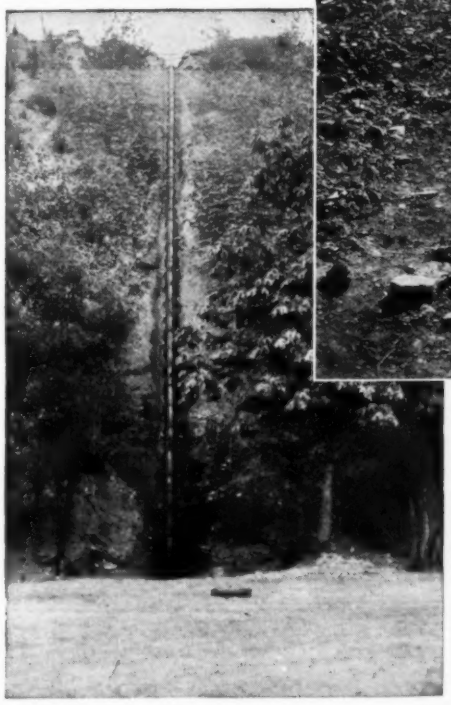
Specify UNIVERSAL PIPE for water mains and sewers

Furnished in hot tar dipped, cement lined, and enameline lining.

THE CENTRAL FOUNDRY CO.
386 FOURTH AVENUE, NEW YORK 16

*Reg. U.S. Pat. Off.





Above *All straight lengths of Universal pipe in this curve.*

At left *16" pipe laid on a 45-Degree slope. Note deflection at top to level ground without fittings.*

USE THE COUPON

DEPT. D

THE CENTRAL FOUNDRY COMPANY
386 Fourth Avenue, New York 16

I am interested in SAVING LABOR, TIME, MONEY and EQUIPMENT in pipe-laying. Send me the UNIVERSAL catalog.

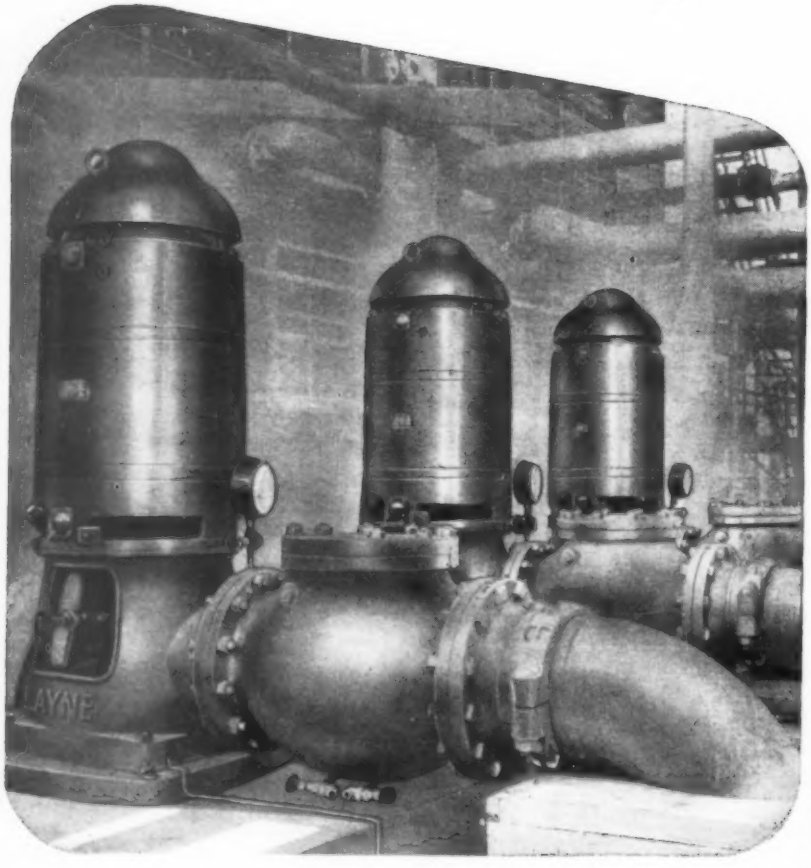
Name .....

Position .....

Address .....

.....

What About Checking On Operation Cost



High Efficiency Brings Big Saving

In selecting a well water system, the matter of operation cost is of prime importance.

For nearly seventy years Layne has been steadily building more and more efficiency into their well water systems. Today they are accepted the world over as being the most economical of all to operate.

And supporting efficiency, there is an extra ruggedness of construction that insures the maximum in long life. Each unit is precision built of finest materials, resulting in a highly perfected and smooth operating system.

It is an acknowledged fact that Layne has built more fine well water systems than any other firm in the entire world. Furthermore, the Layne method of well construction and pump installation is recognized as being far superior to the usual procedure. And once installed, the Layne organization is always available to supply service and parts, when —and if needed.

For helpful well water system information, catalogs, bulletins etc.

Address
LAYNE & BOWLER, INC.
General Office
MEMPHIS 8, TENN.

Noted For Durability

Layne Well Water Systems are constructed in a manner—and from the kind of materials that give years and years of durability. Layne has never lowered their standards of quality or fine workmanship in order to gain a better profit or to meet a competitive situation. Such a policy has remained constant for nearly seventy years.

LAYNE

Vertical Turbine Pumps

Layne Vertical Turbine Pumps in sizes from 40 to 16,000 gallons per minute may be bought for installation in old wells, or for producing water from lakes, rivers or canals. Write for pump catalog.

WELL WATER SYSTEMS

AFFILIATED COMPANIES—Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ Layne-Texas Co., Houston, Tex. ★ Layne-Western Co., Kansas City, Mo. ★ Layne Minnesota Co., Minneapolis, Minn. ★ International Water Corp., Pittsburgh, Pa. ★ International Water Supply, Ltd., London Ont. ★ Layne-Hispano Americana, S.A., Mexico, D.F.
General Filter Company, Ames, Iowa

LINK-BELT Equipment *in* Water Works and Sewage Treatment

● Link-Belt manufactures a complete line of equipment for Water, Sewage and Industrial Liquids Treatment Plants and have applied this equipment effectively to the solution of such problems. Link-Belt engineers have co-operated with consulting, municipal and sanitary engineers, and plant operators in planning and operating plants, for positive results and highest efficiency. For information on any of the following products, write your nearest Link-Belt office.

SCREENING

STRAIGHTLINE BAR SCREENS — for removal of solids over ½" in size, from sewage or industrial liquids. Send for Folder No. 1587.

TRASH SCREENS — for the removal of large floating particles from large volumes of water, thus protecting fine water screens or other water plant or power plant equipment. Send for Book No. 2252.

LIQUID VIBRATING SCREENS — an efficient and economical screen for the removal of solids from industrial liquids. Units are available in several sizes with coarse or fine screen medium. Send for Book No. 1977-A.

GRIT REMOVAL

STRAIGHTLINE GRIT COLLECTORS — for the removal of a clean, washed grit with a low putrescible content, the collecting and thorough cleaning operation with Link-Belt grit washer makes further handling unnecessary. Send for Book No. 1942.

TRITOR SCREENS — are used for the removal of screenings and grit at small sewage treatment plants where grit creates a problem during storm flows. With the Tritor Screen, one mechanism accomplishes removal of both grit and screenings. Send for Book No. 1587.

CHEMICAL MIXING

FLASH MIXERS — for rapid and thorough mixing of chemicals with water, sewage or industrial liquids. A large, efficient four-blade propeller operates without under water bearing. Send for Folder No. 2042.

HORIZONTAL SLOW MIXERS — for rectangular tanks where horizontal flow is desired. The degree of mixing can be reduced as the sewage flows through the tank by decreasing the number and changing the pitch of the paddles. Send for Folder No. 2042.

VERTICAL SLOW MIXERS — for square tanks which can be operated singly or in a series of two, three or four. These mixers will provide efficient mixing and flocculation where vertical flow is desired. Send for Folder No. 2042.

SLUDGE and GREASE COLLECTION

STRAIGHTLINE SLUDGE COLLECTORS — for rectangular settling tanks, Straightline Collectors with peak-cap bearings, pivoted flights and "Straightline" action provide a combination which can't be beat for efficient collection of sludge and grease. Send for Book No. 1742.

CIRCULINE SLUDGE COLLECTORS — for round settling tanks. Circuline collectors are equipped with "Straightline" action which assures quick and positive sludge removal from the entire tank floor in one revolution. Send for Book No. 1982.

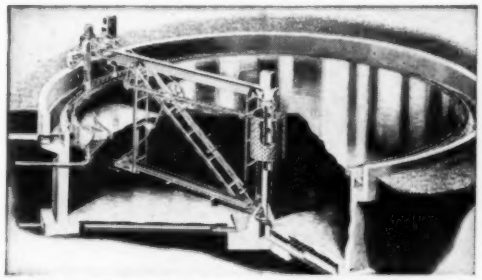
BIO-FILTRATION SYSTEM

This system consists of high rate shallow filters and recirculation of the effluent from the filter to the settling tanks. Features are: great flexibility, high rate of B.O.D. loading and the ability of plants to handle strong domestic and industrial sewage in single-stage or two-stage treatment, as required. Send for Folder No. 1881.

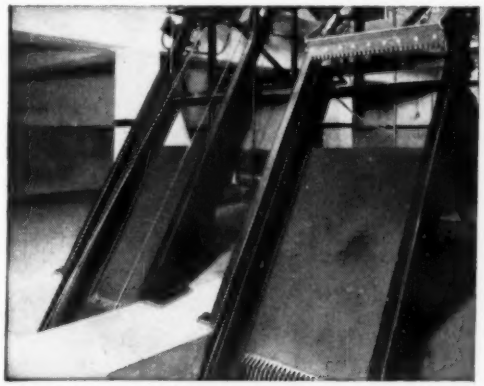
SLUDGE DIGESTION

STRAIGHTLINE SCUM BREAKERS—are used in either round or rectangular digestion tanks to break up the floating scum, paddle it down and submerge it. The scum breaker consists of two strands of chain with pitched flights between them, traveling at a slow speed. Send for information.

Straightline Sludge Collectors for the positive removal of sludge from rectangular tanks. Send for Book 1742.



Circuline Sludge Collectors for the positive removal of sludge from round tanks. Send for Book 1982.



Mechanically-cleaned Bar Screens for removing the larger floating solids. Send for Book 1587.

Straightline Grit Collector and Washer. Effectively collects, washes and removes settled grit and separates it from putrescible organic matter. Send for Folder 1942.

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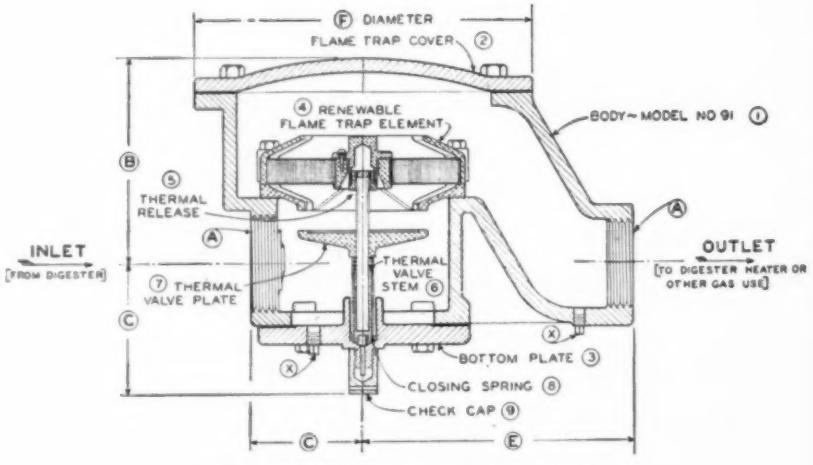
PFT Floating Covers for Sludge Digestion Tanks have minimized the possibility of an explosive mixture being present in the gas piping system . . . PFT flame traps for 15 years have provided the last full measure of explosion prevention. Almost 2,000 units have successfully provided complete protection from explosive and burning mixtures passing flame into a gas supply line without the use of a liquid seal. Flame elements have passages as large as possible to reduce clogging and pressure losses yet small enough to prevent flame propogation; are rugged so as not to rupture while preventing an explosion; are non-corrosive in the presence of Hydrogen Sulphide, etc.; are readily removable for inspection. New improvements include: horizontal connections for easier installation; internal, accessible thermal plug to eliminate nuisance closure and possibility of gas leakage; body castings arranged for straight-through flow and designed in accordance with American Standards Class 125; more accessible replaceable parts; flame checks at all vent connections.



PFT MODEL NO. 91 FLAME TRAP

Send for Bulletin 221 which describes flame traps, pressure reliefs, waste gas burners, drip traps, pressure gauges, and suggested layouts for piping of gas safety systems.

PFT

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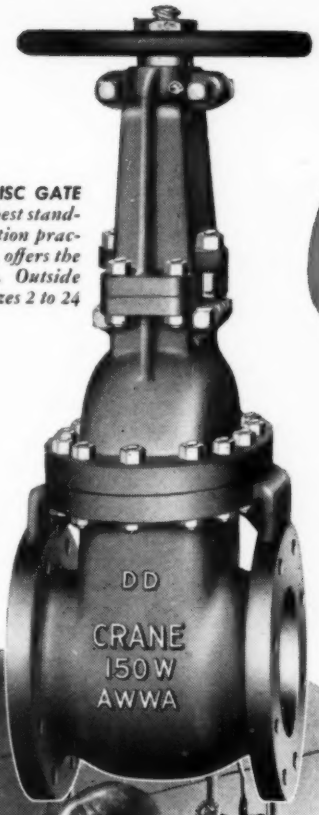

A.W.W.A. IRON BODY DOUBLE DISC GATE VALVES *by Crane meet today's highest standards of water supply and distribution practices. Crane No. 2495, shown here, offers the best valve performance in its class. Outside screw and yoke; flanged ends; in sizes 2 to 24 inches. See your Crane Catalog.*

MOTOR OPERATED CONTROL VALVES *to mains in a large pumping station. The Crane line includes valves of all types and sizes.*

why do you find CRANE VALVES wherever flow is controlled?

BECAUSE their record for dependable performance is second to none. Operating under a variety of conditions, Crane valves have for generations given municipalities the trouble-free service that minimizes repair and replacement costs.

BECAUSE wherever valves are needed—in water works, sewage disposal plants or water distribution systems—large or small—the complete Crane line is most likely to include the valves and accessories you need. And no matter what size or type of valve you choose—if it's Crane Quality, it's sure to stay on the job of maintaining water utilities at peak efficiency.

CRANE CO., 836 South Michigan Avenue
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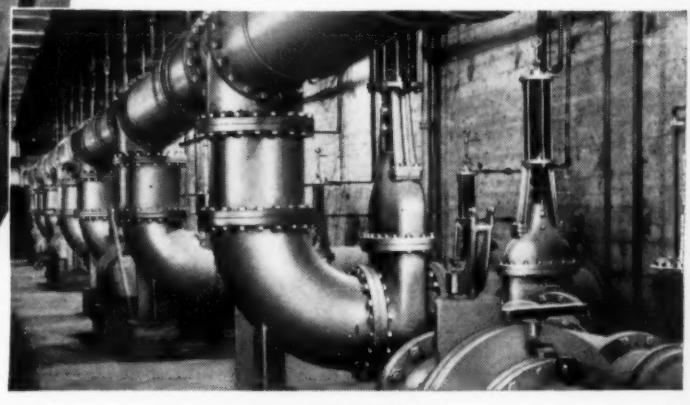
MAIN PIPE GALLERY *in new municipal water treatment plant equipped with Crane 8-in. re-wash valves, 14-in. effluent valves and 24-in. wash valves—all cylinder operated.*



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The Sludge Blanket in the Permutit Precipitator acts as a filter...SAVES YOUR EXPENSIVE CHEMICALS!

The positively agitated uniform sludge filter in the Permutit Precipitator will save you up to 50% in space and 75% in time of treatment too!

The Permutit Precipitator offers you the newest and most efficient means of removing impurities from your water. It does this by precipitation, adsorption, settling, and upward filtration. Write for full details to the Permutit Company, Dept. W-9, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.

FOR 35 YEARS
WATER CONDITIONING HEADQUARTERS

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In an Emergency or ANY Time

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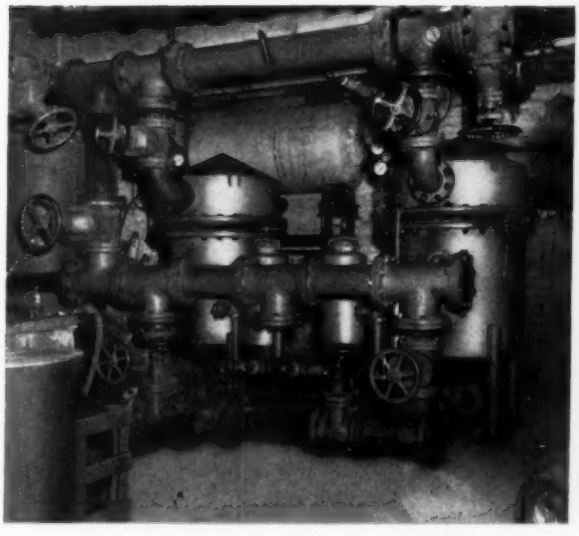
Means Clear, Safe Water

When Gasport, N. Y. needed water filtration and chlorinating equipment in a hurry this summer, it was %Proportioneers, Inc.% that supplied it. A complete Pur-O-Cel System, flown direct to the drought-stricken area, rendered impounded creek water safe and clear — relieved what might have been a serious health problem.

%Proportioneers% Pur-O-Cel System combines highly efficient diatomaceous earth filtration with automatic hypochlorination. The system requires unusually small space, which saves construction and housing costs. %Proportioneers% duplex Chem-O-Feeder feeds both filter aid body-coat and hypochlorite. Finished water is clear and brilliant — turbidity is completely eliminated. Operation is simple and economical — Pur-O-Cel is backwashed with a minimum of water and thereby quickly restored to its original efficiency. — When you think of pure water, think of %Proportioneers% — over 27,000 %Proportioneers% units are working in all parts of the world. Write for Bulletin 1550.



Two-unit installation of %Proportioneers% Pur-O-Cel System. Note very compact arrangement of the diatomaceous earth pressure filters, and the simple piping layout.

% PROPORTIONEERS, INC. %

PROVIDENCE 1, R. I.

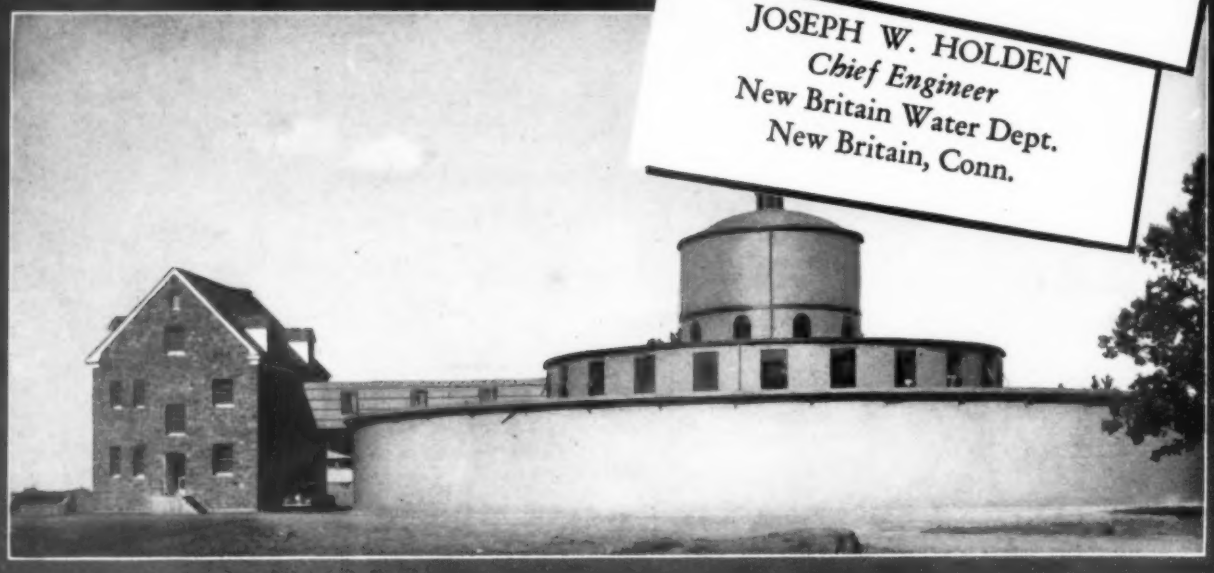
NEW BRITAIN, CONN.

Morse Filter Plant

(Completed in 1940)

JAMES A. NEWLANDS
Consulting Engineer
Hartford, Conn.

JOSEPH W. HOLDEN
Chief Engineer
New Britain Water Dept.
New Britain, Conn.



When this circular steel filtration plant went into operation, a better, purer water supply became available to the more than 70,000 people of New Britain, Conn. The circular design of the present plant makes possible centralized, convenient control of the settling basins, filters, treating systems, and pumping equipment. Builders-Providence equipment, installed by Chicago Bridge & Iron Co. and Hayes Construction Co. of New Britain, meters the raw water and controls the flow of effluent for optimum plant efficiency. For Bulletins describing Builders water works equipment, address . . . Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.

Builders-Providence equipment furnished for the Morse Filter Plant at New Britain, Conn.

Raw Water Meter —

1—30" x 15" Herschel Standard Venturi Tube

1—Chronoflo Transmitter and Totalizer-Recorder

5—12" x 6" Effluent Controllers

5—Loss of Head, Rate of Flow, Indicating and Recording Filter Gauges

BUILDERS PROVIDENCE
Instruments

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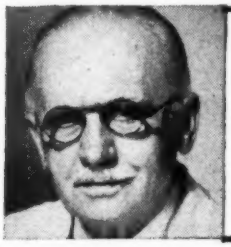

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For over two generations, B&A Reagents have had the reputation of "setting the pace in chemical purity." These quality chemicals always meet or exceed exacting A.C.S. specifications. For the best, be sure to "specify B&A."

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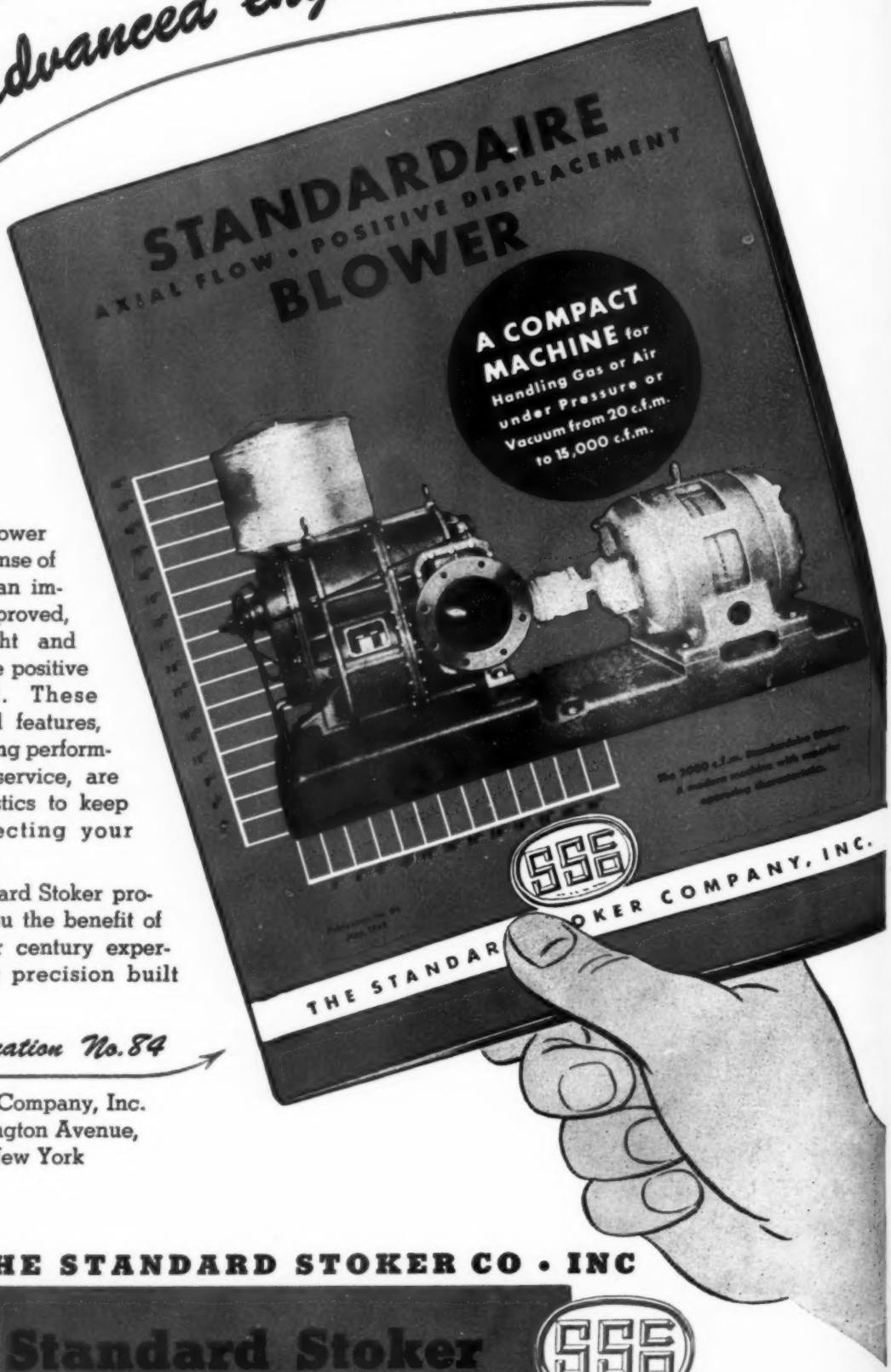
SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

*Complete stocks are carried here.

Here's a New Blower

with advanced engineering features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AXIAL FLOW • POSITIVE DISPLACEMENT
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A COMPACT MACHINE for Handling Gas or Air under Pressure or Vacuum from 20 c.f.m. to 15,000 c.f.m.
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Write for Publication No. 84

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PIGS or BAGS—take your choice!

Hydro-tite is now available in handy pig form—twelve little pigs to the square—two squares to the sturdy fifty-pound carton. They're easier to handle, easier to melt and no waste whatever. Try them, we think you'll like them!

Of course Hydro-tite is always available in 100 lb. moisture-proof bags. Has been for 35 years. Some people will always prefer it that way—but we say "try the pigs".

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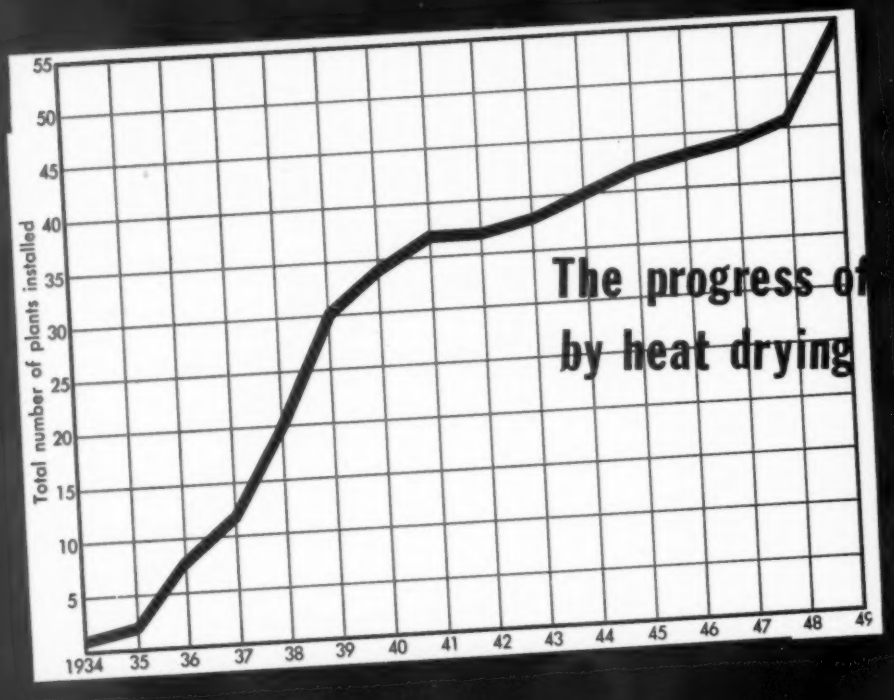


65%

NICHOLS installations

35%

Those of all other Mfrs.

In the overall field of sewage sludge disposal by . . .

incineration to sterile ash
heat drying for fertilizer and
combination drying or incineration . . .

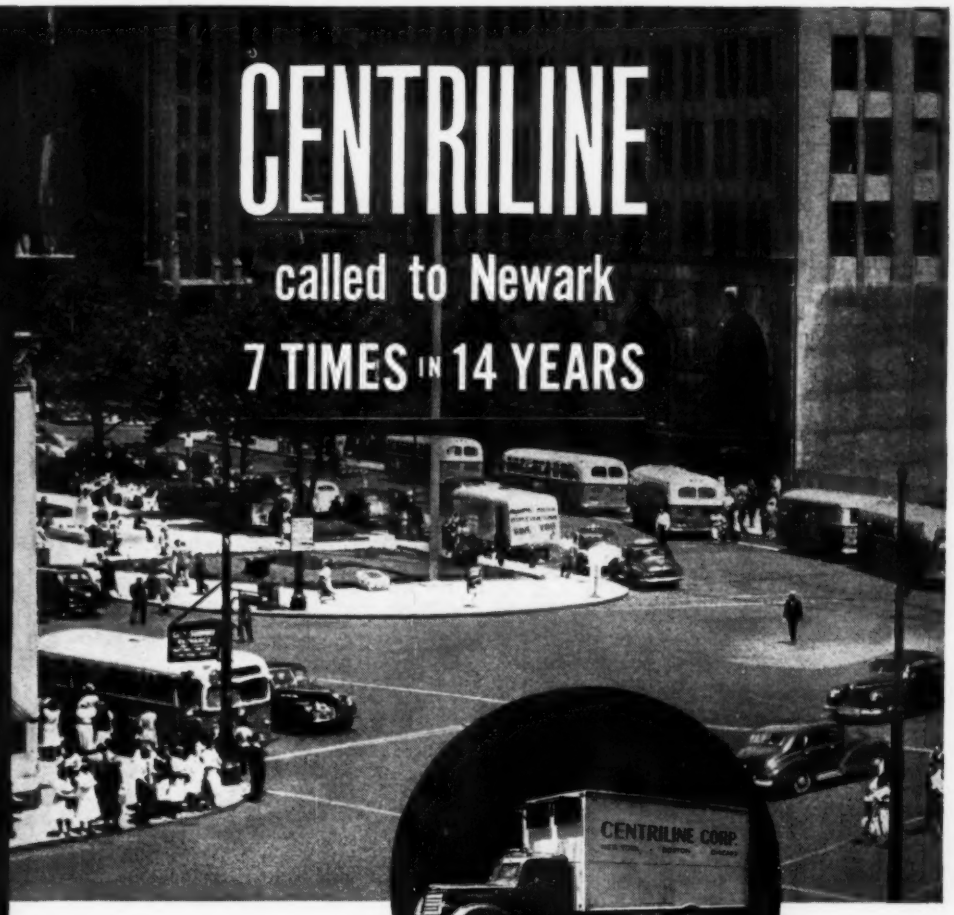
it is worth remembering that 65% of the contracts awarded by municipalities have been to Nichols Engineering & Research Corporation THERE MUST BE A REASON.

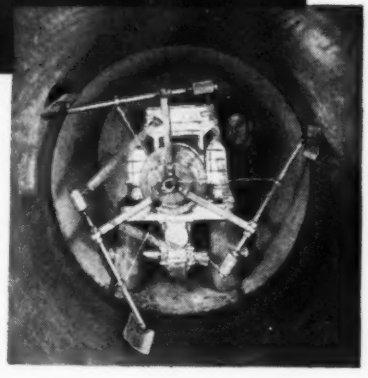
We will gladly send you Bulletin No. 201A

where performance counts . . . count on Centriline

CENTRILINE

called to Newark 7 TIMES IN 14 YEARS





IN 1935 Centriline did its first work for the city of Newark, N. J.—cleaned and lined with cement mortar 27,551 feet of 48" riveted steel pipe. The capacity of this 40-year old pipe was thereby increased 77%—*12% higher than the original capacity—and it has stayed there!*

That may explain why Centriline has been called back again and again to recondition more of Newark's vital water mains. To date, more than 40 miles of these mains have been Centrilined.

If your pipeline investment is under attack by tuberculation and corrosion—if your maintenance and pumping costs are rising—if your mains deliver less water at a time when you need more—call on Centriline. Like Newark, your city will find that it pays!

CEMENT MORTAR LININGS FOR WATER MAINS CENTRIFUGALLY APPLIED in strict conformity with A. W. W. A. Specifications.

CENTRILINE CORPORATION

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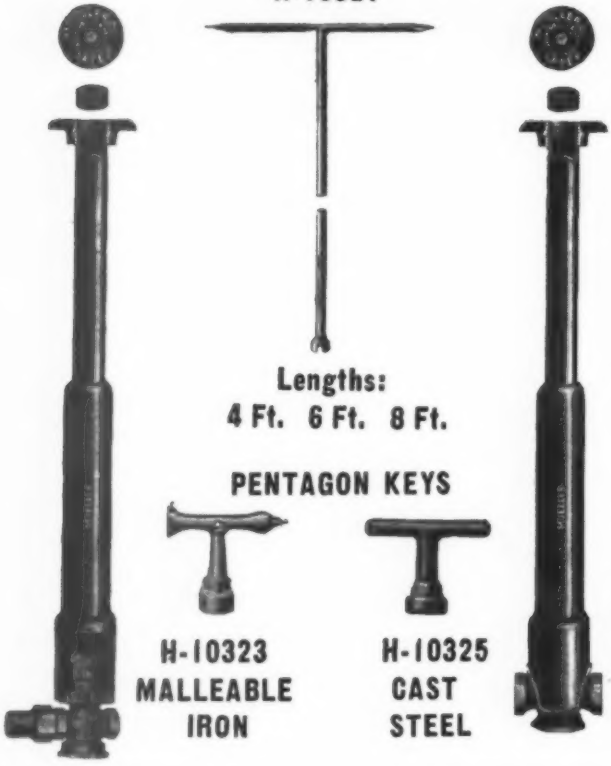
NEW YORK 6, N. Y.

MUELLER SERVICE BOXES THE LINE

WITHOUT INSIDE ROD
USE H-10321 SHUT-OFF ROD
H-10321



Lengths:
4 Ft. 6 Ft. 8 Ft.

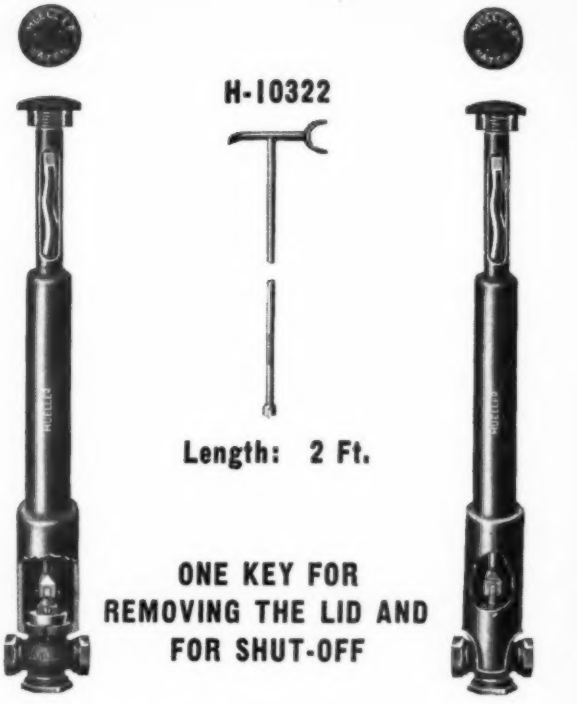
PENTAGON KEYS

H-10323 MALLEABLE IRON

H-10325 CAST STEEL

MINNEAPOLIS BASE		ARCH BASE
H-10300	1¼" Upper Section	H-10306
H-10302	1½" Upper Section	H-10308
H-10304	2 " Upper Section	H-10310

WITH STATIONARY ROD
USE H-10322 SERVICE BOX KEY



H-10322

Length: 2 Ft.

ONE KEY FOR REMOVING THE LID AND FOR SHUT-OFF

MINNEAPOLIS BASE		ARCH BASE
H-10312	1" Upper Section	H-10314

These boxes permit the use of the shorter and lighter Service Box Key which also removes the lid.

All MUELLER Service Boxes have a telescopic construction feature that permits the upper section to slide freely up and down in the lower section, yet it is held in any desired position by means of a strong phosphor bronze spring located in the base. Sudden striking of heavy weights will not damage the stop—Frost Heave may raise the shaft without disturbing the base—It adjusts itself to ground level changes—It remains at the desired height when being installed— These are just a few advantages of this type of construction that means easier and longer life installations. When ordering, be sure to give Size of Stop, Style of Stop, Length of Box, and Pattern of Box.

DEPENDABLE SINCE 1857 FULLY WARRANTED OUR 92nd YEAR

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Bulletin on POROUS MEDIA

by CARBORUNDUM
TRADE MARK

NO. 5 SEPTEMBER, 1949

POROUS SEPTUM TRICKLES...

Manufacturers now regularly supplying filters with ALOXITE elements are Proportioneers, Inc., Refinite Company, Swenson Evaporator Div. (Whiting Corp.), Cooperative Industries, Inc., Landon Standard Pools.

Diatomite filters have proved so effective in bacterial removal and practical as to overall cost that they are now under consideration for municipal water filtration.

Diatomite filters require a small fraction of the space required by other types of filter equipment. This usually affects a substantial saving in housing structure.

Porous Tube Septums Assure High Efficiency of Diatomite Filters

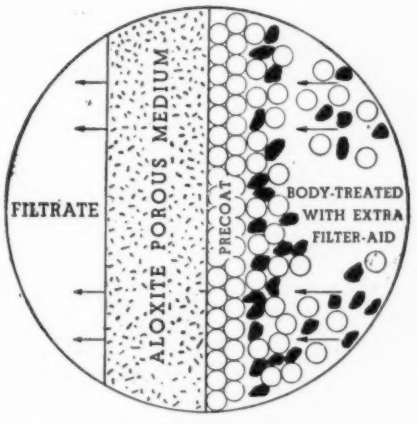
Long accepted for filtration of fine chemicals, liquors, wines, plating solutions, etc., the use of diatomaceous earth filters received added impetus during World War II. It provided a practical mobile method of obtaining potable water supply. Today, expanded usage includes water filtration for swimming pools and industrial plants. Other applications for this equipment are developing constantly.

Of definite help in diatomite filter operation has been the use of ALOXITE aluminum oxide porous ceramic tubes. They were established pre-war as the best septum or support element for several manufacturer's filters. War experiences added confirmation.

For each grade of diatomite filter media a correspondingly proper grade (pore size) of ALOXITE septum is available. Among the unique advantages it offers are:

1. Permanent corrosion resistance assures maximum septum life and minimum replacement expense.
2. High percentage of pore area improves filter operation because of low unit rate of filtration and thereby minimizes clogging difficulties.
3. Uniform distribution of back wash maintains full area of filter and thereby provides maximum efficiency over given time period.
4. Normal ability to function as a filter provides partial clarification and may permit continued use of equipment in emergency absence of diatomaceous filter media.
5. Low septum cost reduces initial price and service expense.

These benefits are automatically incorporated in new and modern equipment offered by a number of filter manufacturers with whom filtration problems should be discussed. The Carborundum Company cooperates with manufacturers in the supply of ALOXITE septums of the required grades.



Principle of Diatomaceous Earth Filtration

Properties of ALOXITE Porous Media

MATERIAL	Ceramically bonded crystalline aluminum oxide grain of controlled sizes.
GRADES (Pore size)	**Filter Underdrains**... coarse and very coarse. **Direct Filtration**... range from very fine to medium. **Diatomite Support**... range from fine to medium. **Air (gas) Diffusion**... range from fine to coarse (permeability from 10 to 120.)
SOLUBILITY	**In Water and Air**... insoluble at all normal operating temperatures. **In Acids**... generally resistant at all operating temperatures, except to hydrofluoric acid. **In Alkaline Solutions**... ceramic bonds are progressively soluble with time and temperature increases.
STRENGTH	Transverse breaking strength is relatively good ranging from 1000 lbs./sq. in. (coarse grades) to 3000 lbs./sq. in. (fine grades).
REFRACTORINESS	All grades withstand up to 900° C. without softening.
THERMAL SHOCK RESISTANCE	Withstand changes up to 20° C./hr. (Where more severe heat shock exists, ceramically bonded silicon carbide porous media are available.)
POROSITY	Ratio of pore volume to total volume of all grades approximately 35%.
WEIGHT	Approximately 0.09 lbs./cu. in.

TECHNICAL DATA on porous media and their application is available on request. You may obtain any or all of the following engineering bulletins by writing Dept. O-99. No. 1—Aeration of Sewage and Water. No. 2—Underdrain Systems for Filters and Softeners. No. 3—General Catalog information.

THE CARBORUNDUM COMPANY • Refractories Division • Perth Amboy, New Jersey

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Helpful... Cooperative... Experienced...

YOUR TRIDENT REPRESENTATIVE

With operating expenses high and customers opposed to increased water rates, your Trident Representative is a mighty helpful man to know... because he can help you with your metering problems in the field and in the shop — and, in many cases, help you to get money for more of the water you pump. His help will be based on practical know-how in the water works field, especially meter testing and repair. Your Trident Representative is more than just a meter salesman — he is ready to work with you at any time. Don't hesitate . . . call him in.

206

A GOOD METER PLUS GOOD SERVICE

A PERFECT COMBINATION

Trident Meters are not only accurate over a wide range of flows, but retain their sensitivity to low flows for the longest period of time.

Even after Trident Meters have been in service for a long time, they can be quickly, easily and economically repaired to restore their original accuracy and sensitivity.

A well planned program of meter testing and repairing can easily be put into operation. It needs no elaborate equipment. For valuable information on this subject, ask for our Manual—"Planned Meter Repair and Testing." Your Trident representative will be glad to assist you.

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Branch Offices in Chicago, San Francisco, Los Angeles, Portland, Ore., Denver, Dallas, Kansas City, Louisville, Atlanta, Boston.
NEPTUNE METERS, LTD., Long Branch, Ont., Canada

WATER & SEWAGE WORKS

VOL. 96. NO. 9 SEPTEMBER. 1949

A Gillette Publication

THE CHEMISTRY OF WATER TREATMENT

V. Some Unusual Water Treatment Problems

by

A. P. BLACK, Head

Department of Chemistry

UNIVERSITY OF FLORIDA

GAINESVILLE, FLORIDA

THE preceding papers in this series have dealt with the basic theory underlining some of the more important methods of water treatment and of their control in the laboratory. It must not be assumed, however, that these principles provide a sure and infallible guide to the successful treatment of all waters. Every consulting engineer who deals regularly with problems of water treatment is familiar with the fact that there are certain instances in which usual treatment methods appear to fail, or if they do not fail completely they still do not yield the results which might be expected. It is the purpose of this fifth and last paper in the series to present a number of such cases in some detail with the thought that the technics which have been developed may prove useful in other situations and, more important, to point out that there still remain areas in the field of water treatment within which our knowledge of what takes place is still incomplete.

The Author
(President A.W.W.A.)

Coagulation For Color Removal

Unquestionably the most commonly used method for the removal of color from water consists in the addition of a suitable coagulant, which, in this country, is usually aluminum sulfate, although ferric salts are also widely used. It was pointed out in

Front View of Gainesville, Fla., Softening Plant
(Placed in operation in December, 1948)

Laboratory of Bradenton, Fla., Water Treatment Plant
(This plant was awarded the State Bd. of Health Certificate of Merit for the best operated and maintained plant in the state in both 1948 and 1949.—Thomas Paul, Supt. and Chem., shown.)

Part I of this series that coagulation is based upon the precipitation of a negatively charged colloid by a trivalent ion of opposite charge. That being true, one might expect all waters containing organic color to respond in the same fashion, but such is not the case. Indeed, the behavior of waters which appear to be closely identical in physical properties and chemical composition may vary quite widely. Three examples will be cited to illustrate this point.

The **City of Bradenton** obtains its water supply from a surface reservoir created by an earth-fill dam across the Braden River. While, like most surface supplies, its composition exhibits seasonal variations, an average analysis will be of interest. It is *Water A* of the accompanying Table. The alkalinity varies from 20-35 ppm. and the organic color from 125 to as high as 300. The treatment of this water consists in coagulation with aluminum sulfate without the addition of any alkalinity. Alum dosage varies from 3.2 to 6.5 gpg. and the pH of coagulation is 5.4 to 5.6. The floc formed is a true "color floc," large and heavy, which settles well. Color removal is excellent and the color of the stabilized and filtered water rarely exceeds 15 and is often below 10.

The plant of the **Pinellas County Water System** treats a water which is closely identical with that of Bradenton. It is a soft, highly colored surface supply obtained from two small reservoirs behind earth-fill dams. It is *Water B* of the Table. As in the case of Bradenton, color may reach very high values, a color of 400 being occasionally obtained and the average falling between 200 and 300. The alkalinity of this water rarely exceeds 10 ppm. and its mineral content is somewhat lower than that of Bradenton. Successful coagulation requires the addition of an alkali with the alum and either hydrated lime or soda ash may be used. The former is employed because of its lower cost. If an attempt is made to coagulate the water without the addition of an alkali, it is not possible to secure the "color floc" typical of Bradenton. The floc which is formed is very small and settles poorly.

The third water is that of the **City of Fort Pierce.** Like the other two, it is a soft, highly colored surface supply obtained from a marshy savannah adjoining the plant. It is *Water C* of the Table. Of the three waters which are being compared its behavior is perhaps the most unusual. If alum alone is added, the result is either no floc at all or a very fine floc which refuses to settle. If hydrated lime is added with alum, results are equally poor and no satisfactory floc can be obtained. If a dosage of 20 to 30 ppm. of soda ash is added to the water before the alum, the result is a large and well formed floc, which settles readily, and excellent color removal is obtained.

Here, therefore, we have three soft, highly colored surface waters, each of which requires a completely different type of treatment. Whether these differences are due to differences in the mineral content of the waters or whether they are due to different types of organic color present in the water is not known. The latter theory seems the more probable of the two. However that may be, the situation illustrates the absolute impossibility of predicting in advance the proper treatment for a given water and the necessity for careful and complete preliminary studies before plant design is undertaken.

Color Removal By Softening

Of the 353 public water supplies in Florida, 327 or 92.6 per cent, are derived from wells, and since well waters throughout the state are quite hard, the majority of Florida's water treatment plants are softening plants, there being 31 municipal lime or lime soda softening plants in the state at the present time. The limestones

Table I

CHEMICAL ANALYSES OF UNTREATED WATERS DISCUSSED IN PAPER

Constituent	Parts Per Million									
	A	B	C	D	E	F	G	H	I	J
Total dissolved solids	172	67	134	337	325	445	460	187	224	260
Silica, SiO_2	3.4	6.0	9.0	7.4	18	23	9.2	25	8.0	5.2
Iron, Fe	Tr	Tr	0.14	0.6	2.0	1.3	0.2	0.1	0.05	0.5
Calcium, Ca	15	5	18	92	100	134	114	35	38	86
Magnesium, Mg	7.7	3.2	2.2	5.4	2.0	4.0	4.9	13	9.0	Tr
Sodium and potassium, Na plus K	15	10	9.4	13	20	28	42	12	26	9.0
Bicarbonate, HCO_3	35	15	52	263	293	373	366	163	125	235
Sulfate, SO_4	31	5	8.9	26	5	35	2.0	10	24	24
Chloride, Cl	31	25	16	20	26	45	69	12	35	12
Organic color	200	250	250	55	80	60	65	55	65	6
Carbonate hardness as $CaCO_3$	29	12	43	216	240	306	300	134	103	193
Non-carbonate hardness as $CaCO_3$	39	15	11	36	18	44	6	6	29	24
Total hardness as $CaCO_3$	68	27	54	252	258	350	306	140	132	217

A—Impounded surface supply, Bradenton
B—Impounded surface supply, Pinellas County
C—Surface water from Savanna, Ft. Pierce
D—Present well supply, Miami
E—Well supply, Ft. Lauderdale
F—Well supply, St. Augustine
G—Well supply, Ft. Pierce
H—Well supply, Lake City
I—Water from Lake Okeechobee
J—Water from new well field, Miami

which underlie the Florida peninsula are in many areas porous and cavernous and penetrated by surface fissures and sink holes. The result is that water from most shallow wells and many deep wells penetrating these limestone formations contains organic color and other material of surface origin. The problem faced by most of Florida's softening plants, therefore, is the removal of both organic color and hardness, and the question of color removal during softening becomes a very important one. Not all waters behave alike in this respect.

The **City of Miami** derives its municipal supply from some 17 shallow wells penetrating a very porous limestone formation. The composite analysis of these wells is shown as *Water D* of the Table. Softening with the theoretical dose of quicklime and using 0.5 gpg. of alum as a coagulant, the resulting color is 27 to 30. If, however, excess lime softening is employed so that the water leaving the clarifiers contains from 20-30 ppm. excess CaO the color is reduced to about 22. The same is true of the supply of the **City of Fort Lauderdale** (*Water E* of the Table).

On the other hand, the waters at Saint Augustine and Fort Pierce (*Waters F* and *G* of the Table) will not respond in this fashion. Dosages of lime far in excess of the theoretical dosages fail to lower the color below 35 ppm. At **Saint Augustine** (*Water F*) therefore, the treatment is to first soften the water with lime and soda ash, settle it, after which it is coagulated with alum for color removal, settled again and filtered. This results, of course, in a rather high treatment cost.

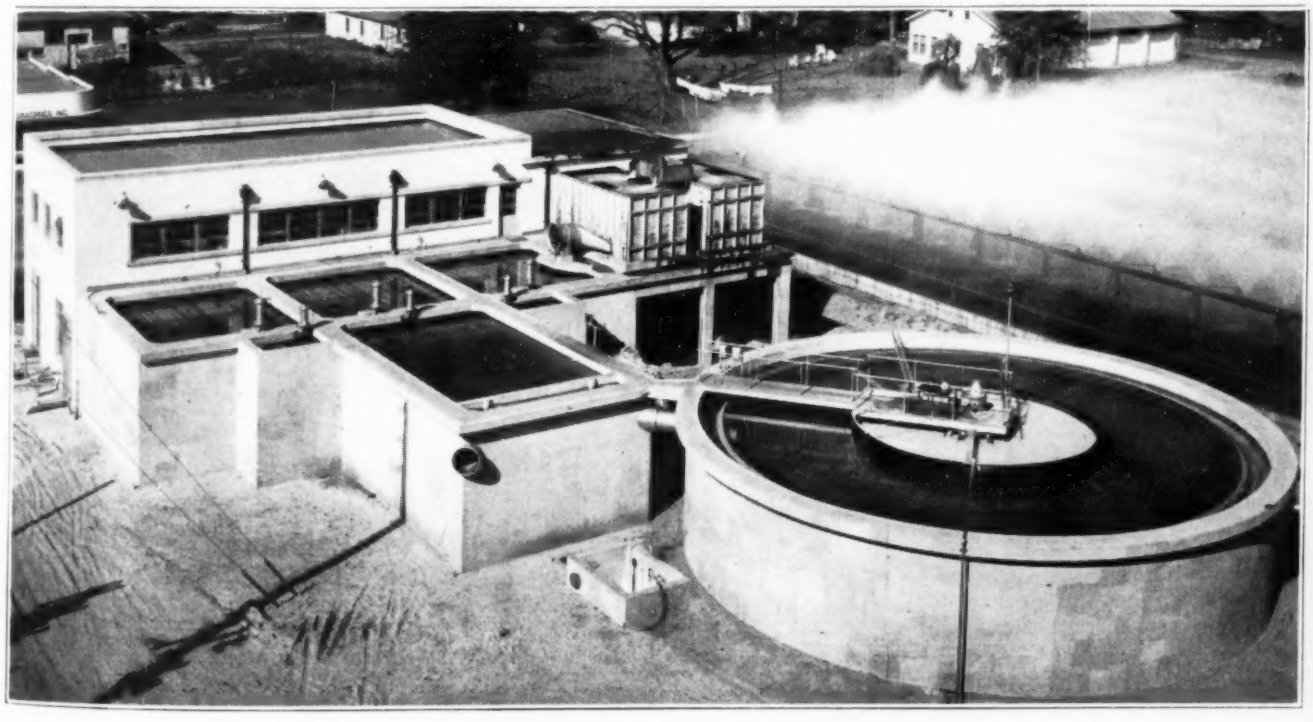
At **Fort Pierce** (*Water G*) the problem has been solved rather ingeniously by constructing two separate treatment plants. Hard water from wells containing organic color is softened in a solids contact type unit using excess lime which reduces the color to about 30. The older coagulation plant treats the soft surface water by a process already described, producing a water having an organic color of 6 to 8 and a low pH. The two waters are mixed before filtration and the excess lime in the softened water is held at a point sufficient to stabilize a mixed effluent. By varying the volume of water treated in each of the two plants, a water of any desired quality may be produced.

The statement is often made that excess alkali will "set" organic color in water. It is quite important to note that as applied to the softening of colored water, this statement does not hold. On the contrary in most cases the color will be less as the dosage of lime is increased above the theoretical dose and such excess lime also results in larger, denser sludge particles and much better settling.

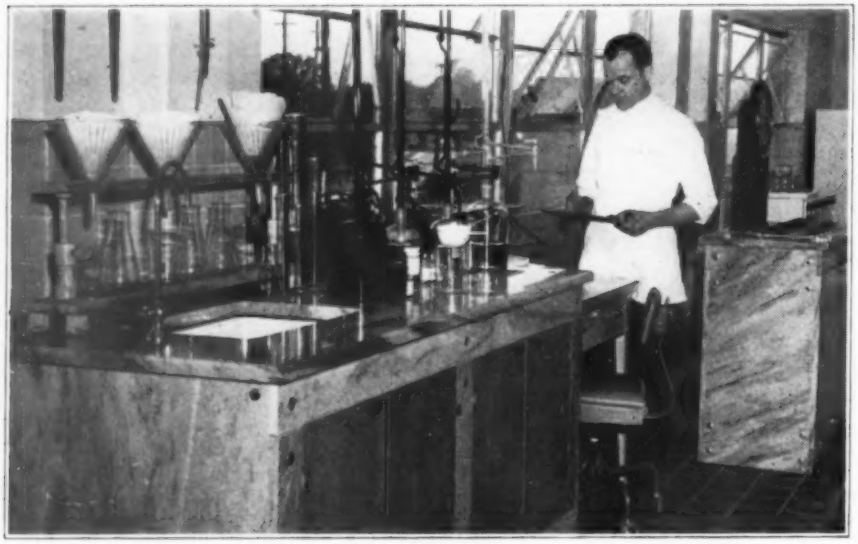
Softening Soft Water For Color Removal

It is well known that as the alkalinity of colored water increases, the dosage of alum or other coagulant necessary for color removal by coagulation increases. At **West Palm Beach,** for example, when the alkalinity of the soft highly colored water is 20 to 30 ppm., the dosage of alum required for good coagulation is usually 4 to 5 gpg. and that is also true of the waters at Bradenton and Fort Pierce. On the other hand when, in periods of low rainfall and high evaporation, the alkalinity rises to values which exceed 100 ppm, the dosage of alum required for coagulation may be 9 to 10 gpg. or even greater. This is due of course to the buffer effect of the alkalinity which makes it necessary to add increasing dosages of alum to lower the pH to the range in which good coagulation may be obtained.

In such cases substantial economies may be sometimes effected by softening the water instead of coagulating it. The supply of **Lake City** is an example of such a situation. It is obtained from two wells whose composite analysis is shown as *Water H* in the Table. Jar tests indicated that for successful color removal by coagulation, a dose of 5 to 7 gpg. of alum was required. It was also found, however, that softening with excess lime followed by recarbonation would yield a softened filtered effluent having a color of 15 and a total hardness of approximately 55 ppm., whereas the hardness of the coagulated water would be in the neighborhood of 150 ppm. A softening plant was therefore designed but in such a manner that coagulation



The New Softening Plant of Gainesville, Fla.



Operator's Control Table—Gainesville, Fla., Softening Plant

could be employed if required. This resulted in a lower first cost, a lower treatment cost and a much softer treated water.

During the summer months of high rainfall when the organic color in the wells increases and the alkalinity decreases to 80 to 90 ppm., softening treatment fails and during these periods coagulation is employed. The use of softening during the major part of the year, however, effects substantial economy in operation and yields a more desirable treated water. This same method of treatment is now employed in most of the small cities on the southern shore of **Lake Okeechobee.** The water in the lake is shown as *Water 1* of the Table.

Highly Variable Surface Waters

During the summer months of high rainfall the treatment of surface water in the **Florida Everglades** presents a problem of unusual interest and great difficulty. During most of the year the flow of water is from Lake Okeechobee into the canals which lead from the lake to the Atlantic Ocean. With the advent of the heavy summer rains, however, giant pumps, some of them having capacities as great as 200,000 gpm., are placed in operation and water pumped from the flooded farm lands into the canals. During these periods the water flows from the canals into the lake. The soil throughout the area is almost pure muck to a depth of several feet, resting on underlying limestone. During these periods of heavy rainfall, organic color reaches values of 500 to 600 ppm., total alkalinity may exceed 500 ppm. and total hardness may exceed 800 ppm. To make matters worse, the water in a given canal may vary several hundred per cent with respect to any or all of these constituents within a period of hours. During such periods, dosages of hydrated lime and soda ash as high as 40 and 20 gpg. respectively were used in the old **Belle Glade** plant but results were unsatisfactory. No completely successful method of treating water has ever been worked out although numerous attempts have been made. The problem has been largely solved by extending the intakes into the lake rather than into the canals and so locating the intakes in the lake that as little as possible of the highly colored and mineralized "muck water" will be obtained.

Color Removal By Free Residual Chlorination

Until very recently, the treatment of the municipal supply of the **City of Miami** has been softening with excess lime and the use of 0.5 gpg. of alum as coagulant, recarbonation and sterilization with chlorine and ammonia. This treatment, while satisfactory from the standpoint of softening, has yielded a finished effluent having an organic color of 22 to 30 depending upon the amount of excess lime employed. Elaborate investigations both on laboratory and pilot plants scale were conducted over a period of three years to ascertain the best and most economical method of reducing the color to 10 or below. It was found that it could be reduced by coagulation with 4 gpg. of alum but the cost of this treatment was excessive for the results to be obtained, and the existing plant could not readily be adapted to provide the additional operations.

The use of ozone was carefully investigated and a pilot plant having a capacity of 10 gpm. was maintained in operation for approximately 6 months investigating this possibility. Ozone proved quite effective, a dosage of 2 to 3 ppm. reducing the organic color to 10 or below, and the cost of operation was calculated to be far less than the cost of coagulation. However, the initial cost for installing the necessary equipment was believed to be too high for the results to be obtained. A plant having a capacity of 900 pounds of ozone per 24-hour day would have been required.

Laboratory studies indicated that the break-point of the water lies at approximately 9 ppm. of chlorine and that by reducing the pH value of the softened effluent from the clarifiers to 7.4 to 7.6 and adding the chlorine at this point the color would be reduced to values below 10. In the process of enlarging the plant from 40 to 60 mgd., provision was made for feeding this dosage of chlorine and new basins were added to provide a total contact time of 45 minutes. Following this contact time the water is aerated, stabilized, and filtered. Chlorine is purchased in rubber lined tank cars which are held on a special siding in the plant until exhausted.

The cost of this process is far less than any other process investigated for the reduction of color. It is to be noted that the chlorine is applied to the water following softening and not before softening. Free residual chlorination (i.e. beyond the break-point) of the *raw water* was not found to be practicable. Since it is felt desirable to maintain the hardness of the finished water at approximately 4 gpg., buffer titration curves were run to ascertain the effectiveness and relative cost of stabilizing the water with soda ash and caustic soda. The latter was found to be approximately 4 times as effective as the former and since an ample supply of excess lime is available from the new sludge calcining unit it was decided to manufacture caustic soda in dilute solution from lime and soda ash. This is carried out in a regulation type solids contact treatment unit having a capacity of 300 gpm., and the resulting dilute solution of caustic soda is mixed with the aerated water just ahead of the filters. Although water treated by the new process is far superior to the former effluent both physical and chemical quality, the adoption of sludge recalcining and free residual chlorination is effecting a saving in treatment cost of approximately $100,000 annually.

Free residual chlorination for color removal is also being employed at **Fort Lauderdale** but at that plant

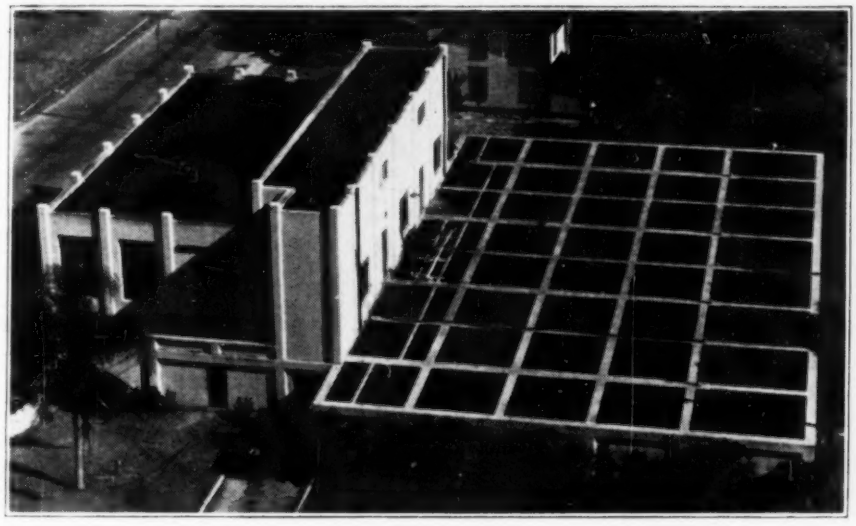
the dosage, which averages about 8 ppm., is applied to the raw water before softening. The plant with the additions recently completed now has a capacity of 14 mgd.

Activated Silica As A Coagulant In Lime Softening

It is believed that the Miami pilot plant studies in 1942-43 represent the first application of activated silica as a coagulant in lime softening. The results of these studies were applied on a full plant scale in the municipal softening plant of the City of Vero Beach, Fla., and somewhat later in the softening plants of the Naval Training Station at Opa Locka, Florida, and at Morrison Field, West Palm Beach, Florida. In all of these early applications to softening the Baylis' sol was used. The application of activated silica sols to water softening resulted immediately in a search for new and better methods of activation. Following the announcement that ammonium sulfate could be employed, it was first used on a plant scale at **Fort Lauderdale,** Fla., where it replaced a dosage of 2 to 4 gpg. of filter alum and effected substantial economies in treatment cost.

The most unusual example of the effectiveness of activated silica as a coagulant which has come to the author's attention is in the treatment of water from the new well field which will be used to supply the new Southwest softening plant of the **City of Miami.** A typical analysis of the water from the new well field is shown as *Water J* in the Table. It will be noted that it contains practically no magnesium and is very low in both sulfate and chloride. When jar tests on this water were begun it was discovered that it was extremely difficult to form a sludge which would settle. Whereas water from the present well field could be successfully softened and settled by the use of quicklime and a dose of 0.5 gpg. of alum, the same treatment on the new supply resulted in very high turbidities and a sludge which could not be satisfactorily settled. Increasing the dosage of alum to 3 gpg. had little or no effect on particle size or settling. At the end of a 30-minute stirring period, it was impossible to distinguish between two jars, one containing lime only and the other containing the same dose of lime with 3 gpg. of alum.

On the other hand activated silica prepared by any standard method proved remarkably effective. A dosage of 4 ppm. as SiO_2 was found effective on all wells and as little as 2 ppm. was found effective on some wells. Furthermore, it was found that the silica must be added before the lime since if it is added immediately following the lime little effect is observed.



Aerial View of Bradenton Water Treatment Plant

The new 80 mgd. softening plant of the City of Miami is therefore now being designed for lime softening with activated silica as the only coagulant. Carbon dioxide will be used to activate the sodium silicate[3]. Provision is being made, however, for the addition of alum feeders and alum storage if later needed.

The theoretical explanation for the interesting behavior of this and other waters of similar character is not evident. It has long been recognized that the sludge formed in softening high magnesium waters with lime or lime and soda ash settles much more readily than is the case with waters low in magnesium. This is due to the fact that magnesium hydroxide is a highly hydrated lyophylic sol, which when coagulated forms gelatinous flocs of large volume. Since it is known that activated silica sols bear a negative charge, their effectiveness in the softening of low magnesium waters is best explained upon the assumption that the crystalline calcium carbonate sludge bears a positive charge. This will also explain the poor results obtained with alum since the positively charged trivalent aluminum ion would not be expected to precipitate a colloid bearing the same charge.

Clarke and Price[1] report from cataphoresis determinations that calcium carbonate does bear a positive charge. On the other hand, Larson and Buswell[2] report that throughout the entire pH range of water softening it bears a negative charge. It is entirely conceivable that both may be correct and that calcium carbonate may bear either a positive or a negative charge depending upon the conditions under which it is formed. It is likewise possible that some property other than electrical charge may be the controlling factor. Certainly it is evident that our knowledge of what takes place during lime softening is still incomplete and that further studies of the physical properties and behavior of softening sludges are needed.

Acknowledgement

Thanks are due to the following individuals, with whom the author has worked for many years, for supplying some of the data used in the preparation of this paper and for the photographs.

John Kelly, Supt. and R. P. Vogh, Chief Operator, Gainesville Water Treatment Plant.

Thomas Paul, Supt. Bradenton Water Treatment Plant

S. K. Keller, Engr. and Supt., and Harry Kline, Chemist, Pinellas County Water System

Harry Gahn, Supt., Fort Pierce Water Treatment Plant

Clarence R. Henry, Chief Chem., and R. J. Brehm, Chemist, Hialeah Water Plant, Miami

C. R. Fiveash, Supt., and R. G. Heasley, Chemist, Fort Lauderdale Water Treatment Plant

B. F. Martin, Supt., and Marvin Messer, Lab. Tech., Lake City Water Plant

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EMERGENCY PROCEDURE

by
SHERMAN L. ROGERS
Supt. of Distribution
THE WATER BUREAU
HARTFORD, CONN.

SUDDEN and unexpected occurrences are bound to happen sooner or later in every water distribution system, no matter how well maintained it may be. Failure to have a well-defined emergency procedure that will automatically go into operation in such cases is to invite heavy damage suits from the public who may be able to prove negligence. The lack of such a plan may be construed to be negligence.

The Author

The following is a brief description of the emergency procedure now in force at the Water Bureau of the Metropolitan District of Hartford County, Conn.

Our distribution system consists of about 650 miles of pipe, mostly cast-iron, covering an area on both sides of the Connecticut River about 25 miles long and 8 miles wide. Over the course of years we have had several really bad main breaks, while minor breaks, broken off hydrants, and other leaks occur more frequently. One of the accompanying pictures was taken at the height of the flow of water resulting from a broken 30 in. main which occurred on a 4th of July morning several years ago. After looking at the resulting flood, one can readily see why it is necessary to have experienced men available at short notice and to have accurate records of gate locations in their hands so that they can close off the affected area without delay.

Loose Leaf Gate Books

Our record system consists of loose leaf gate books, containing maps on a scale of 40 ft. to one inch, showing the piping and gates at each and every street intersection or between intersections if changes in the piping occur there. These maps are indexed alphabetically by streets and the maps showing the larger gates are starred so that it is easier to pick out the critical gates to be closed first in case of a break. Others also use this system, or variations of it, and many cities rely entirely on large scale block maps. The main thing is to have some available record and not rely entirely on someone's memory or on notes locked up in the office safe.

Emergency Trucks

We have two emergency trucks, both of which are equipped with Payne-Deane gate operating units, gate books and necessary tools to control the escaping water resulting from any kind of pipe, hydrant or meter leak. The larger of these two trucks is here pictured.

During regular working hours, our meter repair and shop crew form the nucleus of the emergency crew. Men from the service pipe and main pipe departments take turns filling in for these men on holidays and weekends from 8:00 A.M. to 4:00 P.M. At night regular crews of four men each work from 4:00 P.M. to midnight and from midnight to 8:00 A.M. These men are all experienced in distribution work, and to further their training in emergency work they are occasionally given problems consisting of a statement that supposing there were a very bad leak at a certain place, what gates would they shut and what else, if anything,

One of Hartford Water Bureau's Emergency Trucks
(Equipped with Payne-Dean Gate Operating Unit)

And—It Had to Happen on a July 4th
(Result of a 30-in. Main Break)

would they do. They work out the answers from the gate book and write down their conclusions. A statement is then given them pointing out their errors or omissions, if any. This training is considered quite important since, in a system of this size, some of the piping can be quite complex, particularly where high and low pressure areas abut on each other.

The cost of such an emergency setup in itself would be excessive were it not for the fact that these men spend their time, when not answering calls, greasing and washing trucks and cars, testing and repairing water meters, and doing the janitor work in our garage and shop building. They also relight lanterns on open excavations on week-ends.

Radio Speeds Repairs

Most of the reports of leaks come in by radio and telephone from the nine Police Departments which cover the area in which we operate. The police usually close off and guard the affected area until our men arrive, when, on request from the foreman, they report back through the police radio system to the one man who always remains at the shop, as to whether or not additional help is needed and also whether it is necessary to get out a repair crew. In either case the man on duty at the shop calls the additional men by phone and many times they arrive in time to help with the shut-down, which, in some cases, may be quite extensive. Most breaks are under control within two hours and recently a twenty-inch main, badly broken by a contractor's shovel, was completely shut off within 26 minutes from the time it was broken, even though it was several minutes before anyone called to report it.

Bad News!

Repairs are started as soon as the crews can be assembled, usually within an hour, and are carried through to completion without letup. Where possible, excavation is done with a small truck-mounted back-hoe or a clam shell bucket, and the pipe is handled by a truck crane. On several occasions gas mains have been undermined and broken and our repairs were necessarily held up until the gas leak could be shut off and repaired. Usually it has been possible to completely restore service within 12 to 15 hours after the break. In cases where customers are without water, a 300-gallon trailer tank is put into service and water is delivered by pails to individual apartments or houses.

Service Leaks

The most frequent calls are those reporting small service or meter leaks. Only one of the four men go out on such calls. If it is a defective meter he changes it, and if it is a small unimportant service leak he lights and barricades the spot and turns it over to the service foreman in the morning. Thus there should always be at least one or two men left at the shop to handle anything serious that may come in.

As a further safeguard one foreman, and one member of the Engineering Department who is familiar with the maps and records, are always on call on week-ends and holidays when others may be out of immediate reach. These men merely stay at home or within reach of a telephone so that they will be readily available if necessary. As yet we do not have a radio system of our own, but the installation of one is under consideration. It is felt that such a system would strengthen our protection during working hours when the supervisory force may be pretty well scattered and also be of material assistance in speeding up operations at night.

Our Water Dispensing Unit
The 300 gal. trailer tank used to distribute water to homes during outage of mains.

IMPRESSIONS OF THE CHICAGO CONFERENCE—JUNE, 1949*

by

NORMAN S. F. WINTER

HALIFAX, ENGLAND

THE A.W.W.A. having been good enough to invite me to their Annual Conference, I feel that it may be of interest to some of its members to know what impressions I formed as the result of my visit.

I would remind you that I do not claim to be an Engineer, Bacteriologist or other water technician; but I am what is commonly known in England as a "policy" member, which means that I am concerned with the present and future policy from a local, national, and international aspect, and not with the day-to-day administration of any water works.

It was indeed a great privilege to attend your Conference, and to meet so many delightful friends representing the many aspects of water supply, all of whom gave my wife and me a welcome, the warmth of which I shall remember as long as memory holds.

It was with mixed feelings of excited anticipation and apprehension that I stepped off the train on the morning of May 30th at Chicago—a state of mind which can be readily understood in view of the fact that I had not the advantage of knowing any of your members. After being duly registered as a delegate—an honor which I greatly appreciated—my circle of acquaintances grew rapidly, and I found myself in the midst of real friends.

I had looked forward with pleasurable anticipation to attending some of your meetings and hearing the presentation and debate on some of the papers; but this was unfortunately denied me, for owing to the illness of my colleague, Mr. Henry Berry, I had to spend the first two days of the Conference in preparation of an address in substitution of Mr. Berry's paper. However, as the result of the facilities granted me, I had little difficulty in coming to the conclusion that the success of the meeting was such as to reflect the highest credit on your President and members of the various Convention Committees.

In a Conference of such magnitude it is only to be expected that one or two difficulties may arise; but if such were the case the promptness and efficiency with which they were dealt rendered them unnoticeable.

My chief impression was one of "bigness"—a state in keeping with the vastness of your country—a quality which I am only able to judge by means of comparison.

Whilst I can readily appreciate your need for huge works and long trunk mains, I am at a loss to understand the great difference between a per capita figure in Chicago of over 200 gphd. and in the U.K. of 50 gphd.

In Washington

The Winter's (left) and Mary Elva Enslow

I have noticed a general sprinkling of lawns in your country, which in England is prohibited during a dry spell such as we have just experienced; but I can hardly believe that this factor of water usage can account for the marked difference.

The U.K. figure of 50 gphd. is apportioned as to 32 gphd. for domestic supply and 18 gphd. for trade, and whilst many of our large industrial concerns abstract water from private underground or other sources, this may not apply to the same extent in the U.S.

At the risk of being accused of criticism, which is of a most friendly nature, I am led to the conclusion that, probably owing to lack of knowledge on the part of the public of the proper use of water, there is considerable wastage. I feel that this must be the case, for I cannot conceive that your administrations, equipped as they are with the most modern plants, would be lacking in their appreciation of the value of the detection of waste caused by leakages and defective fittings.

I have had some little experience in connection with organizing a Conference of some 700 delegates, and I realize how much work and thought must have been expended in the preparation of your meeting, attended as it was by three times that number.

I was impressed by the spirit of friendliness and good-fellowship which was apparent on all hands, and I was particularly struck by the manner in which your very efficient Ladies' Committee organized their part of the proceedings.

It was a gracious compliment when your President invited my wife and myself to support him at the Reception; and it was indeed even a greater compliment to us, as visitors, and to my country when, at the Annual Dinner, I had the pleasant surprise of hearing the strains of our British National Anthem—an incident which moved me and which I greatly appreciated.

I like the idea of making the presentation of awards a separate occasion, and limiting the speeches at the Dinner.

Apart from any addition to my store of water knowledge, to me the great value of being a guest at your conference was that not only had I the opportunity of learning something of your very successful organizational methods, but I was enabled to meet so many friends—friends whose names it would be invidious to mention—but who nevertheless almost overwhelmed my wife and me with their generous hospitality.

For the privilege of attending your very successful Conference, for your generous reception of me, and for all you have done for my comfort and entertainment for an unforgettable experience—Thank you.

*Excerpts from a memo to A.W.W.A. by Mr. Winter, who is Immediate Past-Pres., British W.W. Assn., and President, International Water Supply Assn.

Dean Saville Elected President of A.S.E.E.

Dean Thorndike Saville of New York University College of Engineering has been elected President of the American Society for Engineering Education for 1949-50.

Dean Saville has held his present post at New York University since 1936. He is the engineering member of the New York State Public Health Council, and a member of the National Advisory Health Council.

Dean Saville is a member of numerous engineering and scientific organizations and has just completed his work as chairman of the committee which produced the Glossary of Water & Sewage Engineering Terms.

A.W.W.A. PURIFICATION DIVISION

Technical Sessions Well Attended at Chicago Meeting

A Report by
HARRY A. FABER*
EDITORIAL ASSOCIATE

THIS report covers only the three sessions of the Water Purification Division of A.W.W.A. held during the Chicago Convention, May 30-June 3. Other sessions of the convention have been reported in the July and August issues and elsewhere in this issue.

The chairmen and co-chairmen who presided at the Purification Division sessions were Dr. A. P. Black, president-elect of A.W.W.A., I. M. Glace, chairman of the division, and R. L. Derby, vice chairman of the division.

Officers of Water Purification Division

Chairman	Vice-Chairman	Secretary	Directors		
Jas. E. Kerslake *Supt. Filt.* *Water Dept.* *Milwaukee, Wis.*	*H. E. Lordley* *Asst. Dir.* *Pub. Util.* *Richmond, Va.*	*Ray L. Derby* *Prin. San. Engr.* *Dept. Water & Power* *Los Angeles, Calif.*	*M. E. Flentje* *Res. Engr.* *Am. Wtr. Wks. Co.* *New York City*	*I. M. Glace* *Cons. Engr.* *Harrisburg* *Penna.*	*H. O. Hartung* *Plant Engr.* *St. Louis Co. Wtr. Co.* *St. Louis, Mo.*

Taste and Odor Control in Water Treatment Plants at the Lower End of Lake Michigan, by Leo Besozzi, Cons. Engr., Hammond, Ind., and J. C. Vaughn, Filtration Engr., Water Purif. Div., Chicago, Ill.

In January, 1947, the authors were employed by the City of Whiting, Ind., as consultants for the purpose of "producing a palatable water in the shortest possible time and at the lowest possible cost." When, in 1939, the water treatment plant at Whiting was unable to produce—with existing facilities—a drinkable water from Lake Michigan, the treatment methods at other plants using this source were studied. Ozonation was also investigated and, in a relatively short time, was selected for full scale treatment of the supply. The ozone plant, in conjunction with coagulation, activated carbon, and chlorine-ammonia treatment, proved incapable of producing a palatable water.

Serious pollution from domestic and industrial wastes exists in the vicinity of the Hammond intake; threshold odor numbers of 500 to 1,000 have been observed on a number of occasions. The authors have set up equipment to study "every known type of treatment" and have instituted laboratory control methods. Careful evaluation is reported to prove activated carbon application the most flexible and successful taste and odor control measure. An average dose of 84.5 ppm. reduced the threshold odor 89 per cent (i.e., from 81 in the raw to 9.0 in the finished water).

Coagulation with chlorinated copperas gave a much better floc than had been obtained with alum, and the average dose requirement was found to be only 13 ppm. Fuller's Earth was applied (dry) to remove dissolved and surface oils. Chlorine-ammonia treatment was employed for disinfection.

The authors concluded that chlorine dioxide did not effectively reduce the threshold odor of the water; results with a granular activated carbon filter were largely ineffective, but may have been caused by the lack of filter cleaning facilities; "ozone proved incapable of combatting the taste and odor problem, and it appears that this form of treatment cannot be economically justified at Whiting." The use of powdered activated carbon in conjunction with chlorination, coagulation, Fuller's Earth, and filtration treatment was the only technic by which the authors were able to produce a satisfactory water from this highly polluted source.

Highlights of the Operation of the New Chicago Filters, by John R. Baylis, Engr. of Water Purif., Bureau of Engr., Chicago, Ill.

Studies at the experimental filter plant, operated by the City of Chicago for many years, provided an extensive knowledge of the most suitable methods of treating Lake Michigan water. As a result of this information, many special features have been incorporated in the new South District Filtration plant; Mr. Baylis described a number of these. Of particular importance are facilities for strengthening the relatively weak floc characteristic of this water.

Each filter is equipped with a sand expansion indicating device. The design of wash water troughs was based on findings that they should be located about 8 in. above the sand surface: they probably should be designed on the basis of outside shape rather than merely to carry away wash water.

High rate operation of ten filters (there is a total of 80 filters in the new plant), at rates of 4 to 5 gal. per min. per sq. ft., is "paving the way to setting a figure of 3 gal. per min. per sq. ft. as the rated capacity of rapid sand filters." Operation of the high rate filters is the same as for other filters, except that the former are washed as soon as there is a decrease in rate due to clogging. Average length of run is 15.4 hours at 4 gpm. per sq ft., 10.4 hours at 4.5

*Research Chemist, The Chlorine Institute, New York City.

gpm., and 8.1 hours at 5 gpm. Most of the slow rate filters operate on automatic control, often at rates less than 2 gpm. The average length of run for all filters in December, 1948, was 13.1 hours.

Under the title, "Chicago South District Filtration Plant," this paper by Mr. Baylis has already been published in the July issue of the *A.W.W.A. Journal*. It contains a wealth of detailed information on methods of operation and control, together with evaluation of results, which will be of practical value to every plant operator.

M. P. Crabill, Supt. of Purif., Indianapolis Water Co., commented on the use of cotton plug filters as a testing device for coagulated matter which passes filters. He reported studies showing activated carbon to pass through the cotton plug filters.

J. E. Kerslake, Supt. of Filtration, Milwaukee, discussed high rate filtration of Lake Michigan water. He noted that survey reports by the U. S. P. H. S. have criticized plants which use filtration rates as high as 2.4 gal. per min. per sq. ft.

The Operation and Design of Small Water Works, by Martin E. Flentje, Research Engr., Amer. Water Works Co., New York, N.Y., and I. M. Glace, Cons. Engr., Harrisburg, Pa., with five discussors.

The valuable paper by Messrs. Flentje and Glace has been published in the July issue of the *A.W.W.A. Journal* ("Design and Operational Problems of Small Water Plants"), together with two of the five prepared discussions. The authors of the paper used the term "small" to designate plants with an output below 1 mgd., but pointed out that many plants above this figure should still be so classified because of the manner of operation. Conversely, there are many plants having less capacity which, through skillful operation, should not be so classified.

In comparison with larger plants, a survey of water works sending less than 1 mgd. to the distribution system will generally show them to have: (1) a more complex system of water supply and a greater diversity in type of water source, (2) less specialization of activities by the operating personnel, (3) treatment plants often inadequate to meet the problems involved, and (4) high unit costs.

These characteristics of small plants were discussed in detail, with special consideration of design and operational problems. The authors, as a result of their survey and experience, presented fourteen conclusions which admirably summarize the problems of design and operation in plants of the type discussed. They emphasized that small plants should be designed, as far as possible, with the principal consideration for foolproof operation rather than for the economics of the design. Many small supplies do not meet the recommendations of the U. S. Public Health Service that: "Every water plant engaged in purifying water for domestic use shall be under the charge of a technically trained supervisor."

Five discussors, all operators of small water plants, were selected by five State Health Departments to present the viewpoint of the men responsible for operation.

E. M. Craig, Superintendent, Zion, Ill., concentrated his comments on water quality. Three deep wells are the source of supply in his case, but even for well supplies adequate treatment facilities are needed. Small communities should, but seldom do, have a thorough and competent review of their problems. Mr. Craig considered that job security and a proper scale of pay would contribute largely to higher standards of plant operation. In this respect, the participation of the A.W.W.A. may be especially beneficial.

A. B. Daugherty, Supt., Water Works, East Gary, Ind., recited the problems of the small plant operator who must fill the job of town marshal and several other jobs as well. He described most amusingly, but most impressively, too, the benefits of attendance at short schools and consultation with operators at other treatment plants. Small communities do need technical supervision: at East Gary a new well was connected to the distribution system before the water was tested; it was found too late that the water contained 6 ppm. of iron; a "consultant" designed a pressure filter plant to remove the iron by aeration, but the plant did not remove sufficient iron; finally it was found chlorination could be employed to reduce the iron to 0.2 to 0.3 ppm. which, with stabilization, has proven satisfactory.

E. R. Dougherty, Supt., Water and Sanitation, Bowling Green, Mo., described experiences in the supervision of water treatment plants ranging from the 8.0 mgd. plant of General Motors Corp. down to the 0.25 mgd. plant which he now operates. The superintendent of a small plant is the "country doctor," treating all of its ills himself. Rather than asking for a plant designed for foolproof operation, he would ask

A High Standard Set

Three sessions of the Water Purification Division were a part of the 1949 A.W.W.A. Conference program. The sessions included five reports of committees, three technical papers, two symposiums, and one panel discussion. A brief analysis and evaluation of these sessions may serve to indicate the extent to which the objects of this Division are being attained.

The reports of committees represent a most valuable contribution to "the advancement of the science and art of water purification." It is logical that balanced and practical information should result from concerted study by members of a committee. Frequently, a committee report is a progress report; thus, Division members are kept informed of developments and, likewise, are afforded an opportunity to contribute to the work of the committee.

Only one of the three technical papers was presented by a single author; two papers were the joint work of two authors. These papers clearly fulfilled the objective of "the promotion of progress in the design, construction and operation of water purification works."

The two symposiums and the panel discussion presented ten speakers, and, naturally, as many personal opinions. The varied points of view disclosed by the concerted discussion of a particular problem are definitely a "stimulation of research in the physical, chemical and bacteriological fields, especially on the causes and effects of pollution and methods of purification.

So much for an analysis of the content of these sessions. How can their significance be evaluated? Briefly, it may be said that they exemplified two qualities characteristic of a healthy and democratic organization: first, *cooperative effort* and, second, *individual opinion*. Cooperative effort was evidenced by every paper, every discussion, and every report presented. Individual opinion was evidenced by the many members who took the opportunity to discuss, add to, or disagree with the points of view expressed by the speakers.

The objectives of the Water Purification Division are, as they should be, ambitious ones. Perhaps all these objectives cannot be as well fulfilled at every Annual Conference. This appears to be a time of consolidation of practices; if there is a lack of anything, it is a lack of new ideas and developments. Perfection is never attained, but the 1949 Water Purification Division sessions set a high standard at which to aim in the future.—H.A.F.

only that a plant be designed so that it can be operated efficiently. Competent operators are essential and Mr. Dougherty believes licensing of operators provides a large part of the answer. A method must be found to keep capable men in control of water purification before the provision of safe palatable water can be assured. Municipal officials are seldom aware of the necessity of qualified and efficient management. The education of officials is not the solution, however, because the turnover of these individuals is frequently so rapid as to create an endless job. A mandatory licensing program would impress the officials and would raise the status of those in charge of water plant operation.

Revenue has risen from $14,000 to a present $24,000. The chlorine dosage required is 15 to 20 ppm. and 2.0 ppm. residual is maintained. One year was required before any residual reached a half-mile from the plant, and it is believed that—even with adequate flushing—five years may be required for the residual to reach all through the system.

In replying to the discussors, Mr. Glace pointed out that mandatory licensing may be of little value. Too often a "grandfather's clause" is included, and this defeats the purpose of licensing for many years to come. Because municipal officials seldom see the treatment plant or are aware of its problems, he re-emphasized the importance of adequate design.

American Viscose Corp., Philadelphia, Pa., and (2) SOFT DRINKS, by Bert H. Wells, Chemist, The Coca-Cola Co., Atlanta, Ga.

Mr. Haywood termed the rayon industry a large industrial user of water, since approximately 160 gal. of water is required per pound of rayon. The raw water quality and the processes of manufacture determine the treatment processes. All dissolved and suspended solids must be removed for some processing. Pressure type softeners are generally used, usually employing greensand zeolite, but in some instances carbonaceous and resinous ion exchange materials. The treatment processes employed in specific plants were described in some detail and were illus-

Program Participants

J. R. Baylis, Engineer, Water Purif., Chicago, Ill.

E. M. Craig, Supt., Water Dept., Zion, Ill.

W. U. Gallaher, Supt., Water Dept., Appleton, Wis.

R. W. Haywood, Asst. Div. Engr., Amer. Viscose Corp., Philadelphia

Carl Wilson, Consultant, Los Angeles, Calif.

J. C. Vaughn, Filt. Engr., Water Pur. Div., Chicago, Ill.

H. L. Keinath, Supt., Water Works, Frankenmuth, Mich., recommended an occasional check on plant operation by an outside agency, since one man operation has a tendency to become routine. To obtain the practical and resourceful operators needed in small water works, towns should pay good salaries to keep such personnel on the job. A qualified, well paid, superintendent can make a valuable contribution to civic leadership. Mr. Keinath condemned the "underdesign" of small plants, stating that if design engineers actually operated the plants they design, many modifications would result.

W. H. Willsmann, Supt., Water Works, Neillsville, Wis., told a detailed story of improving operation of a small pressure filter type water plant with which practically everything was wrong. Of 78 mg. pumped, only 21 mil. gal. was paid for. A detention time of 20 min. was sadly inadequate, alum carried through the filter, and the filter was filled with mud balls. Break-point chlorination has made it possible to produce an acceptable water except during periods of flash floods. Out of 680 meters, 620 were found to be dead.

Great interest in the small water works situation was evidenced by discussion from the floor. **C. R. Cox,** New York State Dept. of Health, stated the problem is important because small plants are most numerous: in New York one-half of the water supplies serve less than 1,000 population.

Two councilmen described the point of view of municipal authorities. **Mr. Baumgren,** St. Louis Park, Minn., said a small town is willing to pay for what it receives. He hoped the A.W.W.A. can indicate what is a reasonable scale of water works salaries for communities of various sizes. **F. A. Russell,** Lawrence, Kan., acknowledged the educational value of water works conferences—for municipal authorities as well as for technical men. He called a capable water works superintendent "the best investment the city ever made," and favored the investigation of proper scales of salary. (In this connection see editorial comment on page 278 of the July issue of *Water and Sewage Works.*)

Industrial Water Purification

"SYMPOSIUM: PROCESSING WATER FOR INDUSTRY: (1) RAYON, by R. W. Haywood, Jr., Asst. to Div. Engr.,

Mr. Wells estimated the soft drink industry, served by 6,000 bottling plants, to consume 6.25 billion gallons of water per year. High alkalinity is undesirable in the water because it reduces the tartness imparted by citric and phosphoric acids. Turbidity produces foaming during bottling; organic matter produces sedimentation; taste and odor affect the flavor; and hardness results in cloudy bottles. The necessary quality of water is obtained by complete treatment which includes: coagulation and chlorination, sand filtration, final clarification, and activated carbon purification.

While problems are varied geographically, a simple treatment process which is generally applicable has been developed. This involves treatment with ferrous sulfate (2.5 grains per gal.), chlorine (6 to 8 ppm.), and lime slurry (to pH 8.5) for satisfactory coagulation. Dozens of plants have been built or converted to this process which is termed "ferrous sulfate-chlorine-lime treatment."

Training of operating personnel is the most important contribution to quality control. Mr. Wells' organiza-

tion provides operating handbooks, operates training schools, and employs demonstration treating units in its teaching program. It has 23 field laboratory units, with a total staff of 51, assigned to specific plants.

Bacteria in Zeolites

PANEL DISCUSSION: BACTERIAL REPRODUCTION IN CATION EXCHANGERS: Moderator, W. W. Aultman, Water Purif. Engr., Metropolitan Water Dist. of Southern California.

Mr. Aultman emphasized that bacterial growth of this nature is not a new problem, but that it may be of special importance in the siliceous types of cation exchangers and especially in rental water softener units.

Carl Wilson, Consultant, Water Quality and Treatment, Los Angeles, Calif., reviewed the advantageous conditions for bacterial growth which exist in base exchange softeners. In general, he considers this characteristic one of minor public health significance since little opportunity is provided for human contamination. In the case of small package units (rental softeners) some contamination might well occur. However, softeners may exhibit the same effect (antagonistic organisms) as is found in slow sand filters. Citing experimental studies, he indicated continuous chlorination may keep polystyrene and siliceous materials bacteria-free. Phenolic resins, however, combine with chlorine, and thus chlorination treatment is not effective.

George Klumb, the Culligan Zeolite Co., Northbrook, Ill., reported study of the bacterial contamination of home-type units to be especially important, since several million of these are already in use. Because private wells may contribute soil bacteria, spore-formers, iron bacteria, and coliform types, periodic sterilization of the units is indicated. The gel type zeolites can most readily be sterilized. After much investigation it has been found that a new compound, chloromelamine, containing 50 per cent available chlorine, is most suitable for the purpose. The requirements for different types of resins range from 4.5 to 6.8 grams of chloromelamine per cubic foot of resin. A high bacterial kill is obtained without injury to the exchange material.

Henry C. Marks, Director, Chemical Research, Wallace and Tiernan Co., Belleville, N.J., described some of the properties of chloromelamine. He noted that it is stable and relatively low in reactivity with organic matter. It does not increase the pH value of the water, and is about equally effective whether added with the brine or wash water. The presence of calcium ion in the exhausted exchange material may protect organisms from its bactericidal effect. Various technics of using this material were discussed, and it was indicated that the amount required depends upon the manner of application.

Mr. Aultman, in summarizing the discussion, pointed out that pathogenic contamination of cation exchangers did not appear a serious situation, but that satisfactory methods of sterilization had been developed and demonstrated.

Pollution by Synthetic Detergents

SYMPOSIUM: INFLUENCE OF SYNTHETIC DETERGENT POLLUTION ON WATER COAGULATION. The four participants in this symposium were: J. T. Cross, Prin. Filtration Chemist, Chicago, Ill.; W. V. Gallaher, Plant Supt., Appleton, Wis.; J. W. Hassler, Director of Research, West Va. Pulp and Paper Co., Tyrone, Pa.; and Lindsay Hobbs, Research Dept., Standard Oil Co., Whiting, Ind.

Mr. Cross reported on a brief study of the effect of synthetic detergents on Lake Michigan Water, employing various "domestic" and "industrial" detergent materials. No adverse effect was noted until a minimum concentration of 5 ppm. was present. There are indications that the domestic materials interfere with coagulation to a greater extent than do industrial types. Alum and silica gave the best floc formation; lime addition was important.

Mr. Gallaher expressed concern over the increasing use of synthetic detergents for domestic purposes; treated and untreated sewage may contain increasing concentrations as a result. At Appleton specific raw water coagulation difficulties during the summer of 1948 led him to look with suspicion upon the possible presence of detergents (though probably not more than 1 ppm. could be present). He considers they may be especially undesirable in softened water and may increase the production of tastes as a result of chlorination.

Mr. Hassler described tentative results showing synthetic detergents had (up to a 5 ppm. concentration) no direct influence on taste and odor. There are indications that they may intensify and alter tastes resulting from chlorination or chlorine dioxide treatment. Greater concentrations of activated carbon are required to absorb detergents than are required to absorb tastes and odors.

Mr. Hobbs, speaking as a representative of a detergent producer, reviewed theoretical considerations which may be of importance in water purification. Over 800 million pounds of these materials were produced in 1948, which is only 2.5 per cent of the soap production. In rinse water a concentration of generally 20 ppm., and in the abnormal case 200 ppm., might be present. Methods of analysis of the residual are needed before the effect of these materials can be evaluated. After discussing the "rather reactive" properties of synthetic detergents, he pointed out that they differ widely in characteristics but that simple methods of removal may be devised if their presence actually does affect the operation of either water or sewage treatment plant operation.

Reports of Committees

In one session of the Water Purification Division, five important committee reports were presented. No brief review can adequately convey the details of these reports, but it can note the present status of the work of the committee. Any reader interested in the progress of a particular committee will find that the chairman will welcome correspondence.

OPEN AIR RESERVOIRS, Chairman, Norman J. Howard, Director of Water Purif., Toronto, Ont., Canada.

Mr. Howard presented an outline of what the committee proposes to recommend in its final report. It will recommend, for specific reasons cited, that all future construction (of operating service reservoirs) shall be covered and that, where practical, existing structures shall be covered.

DISPOSAL OF WASTES FROM PURIFICATION AND SOFTENING PLANTS, Chairman, W. W. Aultman, Water Purif. Engr., Metropolitan Water Dist. of Southern California, La Verne, Calif.

This is to be published as the final report of the Committee. It is divided into two sections: a report on Purification Wastes by Paul Haney, Sr. Engr., U. S. Public Health Service, Cincinnati, Ohio; and a report on Softening Wastes by A. P. Black, Prof. of Chemistry, Univ. of Florida, Gainesville.

LOADING CAPACITIES OF WATER TREATMENT PLANTS, Chairman, H. O. Hartung, Plant Engr., St. Louis County Water Co., University City, St. Louis, Mo.

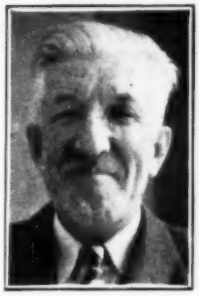
This Committee has, as yet, inadequate data to define and evaluate

what are generally termed suspended solids contact type basins. Another section is to be added to study filtration and to complete the defined purpose of the Committee. The Committee requires the cooperation of those who operate contact type basins, in order to collect more adequate data.

WATER DISTRIBUTION SYSTEM PROBLEMS, Chairman, J. C. Vaughn, Filtration Engr., Water Purif. Div., Chicago, Ill.

Depreciation of water quality within the distribution system is the subject of cooperative investigation by this Committee. The assistance of additional laboratories is gradually being obtained, and more are needed. The work is valuable and important because little study of this nature has ever been reported.

STANDARD METHODS FOR THE EXAMINATION OF WATER AND SEWAGE, Chairman A.W.W.A. Committee, R. L. Derby, Prin. San. Engr., Dept. of Water and Power, Los Angeles, Calif., and H. A. Faber, Chairman, Joint Editorial Board, Research Chemist, The Chlorine Institute, Inc., New York.



Committee Reports

A. P. Black
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Univ. of Florida
Gainesville, Fla.

H. A. Faber
Res. Chem.
Chlorine Inst.
New York City

Paul D. Haney
San. Engr.
U. S. P. H. S.
Cincinnati, O.

N. J. Howard
Director
Water Purif.
Toronto, Ont.

The A.W.W.A. Committee has undertaken an ambitious program of reviewing and developing specific tests. It has recommended the formation of subcommittees to report one or more methods of analysis, and will welcome applications from interested members. The Joint Editorial Board reports general progress in plans for the tenth edition of Standard Methods.

F.S.W.A. BOSTON CONVENTION DEVELOPMENTS

Early indications are that the Twenty-Second Annual Meeting of the Federation of Sewage Works Assns. to be held at the Hotel Statler, Boston, Mass., on October 17-20, 1949, will be a most significant pollution abatement conference. The New England Sewage Works Association is acting as host in the historic "Hub" city.

The membership of the Local Arrangements Committee, which has already completed many of the final details, comprises the following subcommittee chairmen: Gen. Chairman: E. Sherman Chase; Hotel Arrangements: Edwin B. Cobb; Registration: Jack E. McKee; Finance: Thomas A. Berrigan; Transportation: Ralph W. Horne; Inspection: Robert W. Moir; Local Host: Charles G. Hammann; Entertainment: Clair N. Sawyer; and Ladies' Entertainment: Mrs. Thomas A. Berrigan.

Technical Program

The technical program is unusually comprehensive, with major emphasis divided between stream pollution, sewage treatment, and industrial wastes treatment. One full session will be devoted to an "Industrial Wastes Forum." This attraction, which should prove especially interesting to those concerned with this phase of pollution control, will be presided over by Stuart E. Coburn, Chief Chemist, Metcalf and Eddy, Boston. It will run concurrently during the Thursday morning session with the "Operators' Forum," presided over by LeRoy W. Van Kleeck, Prin. San. Engr., State Department of Health, Hartford, Conn.

The Monday afternoon symposium on industrial wastes, received with such acclaim in recent years, will this year feature several outstanding papers on treatment of wastes currently receiving much attention by operators, researchers, and regulatory bodies.

Papers of general interest will include the results of comparative tests and studies of air diffusion for activated sludge, bacterial standards for natural waters, training of sewage works operators, and progress results in the Federation-sponsored experimental research on analytical methods, as well as discussion of mechanical equipment in sewage treatment. An up-to-the-minute account will be given of the progress in solving both the sewerage and treatment problems of Metropolitan Boston, and a full afternoon will be devoted to an inspection trip to the new Nut Island sewage treatment plant and its appurtenant collection structures. Special inspection trips are also being planned to noteworthy industrial waste treatment installations in and around Boston and nearby cities.

The feature of the Annual Federation Luncheon will be an address by Dean Gordon M. Fair, of the Graduate School of Engineering, Harvard University. Always an entertaining and forceful speaker, Dean Fair will discuss the place of the science of sanitary engineering in the changing world.

The New England Sewage Works Association will hold its annual business meeting at a Wednesday luncheon.

Social Program

The social events of the convention will include a Reception-Entertainment on Monday evening, October 17, and the Annual Dinner and Dance on Wednesday evening, October 19. A full schedule of special events for the ladies includes, besides ample shopping time, a "get-acquainted" tea, a tour of historic Boston and Charlestown, and a trip through the history-rich area around Cambridge, Lexington, and Concord, with luncheon at the world-famous Wayside Inn at South Sudbury.

Exhibits and Hotel Accommodations

Member companies of the Water and Sewage Works Manufacturers' Assn. have indicated advance booking of all available exhibit space. Full occupation of the exhibit area by an interesting and diversified showing of equipment is assured.

Hotel reservations may be placed directly with the Hotel Statler, making mention that the accommodations are sought for the Federation Convention.

"BOB" SIMMS HONORED

BY A resolution of the Commissioners of Public Works on June 29, 1949, the City of Spartanburg, S.C., signally honored R. B. (Bob) Simms by officially designating the water filter plant as the R. B. Simms Filter Plant.

A tribute to three decades of faithful service as well as his outstanding ability, this is an honor that rarely comes to a man while he is still alive and active in his profession. The honor was given "in recognition of his great service, his untiring efforts, and his many accomplishments in behalf of the Spartanburg Water Works." Such an honor is a tribute not only to Mr. Simms, the man, but to the water works profession, so ably represented in the person of "Bob" Simms.

The following paragraphs taken from the resolution itself, indicate with what great esteem Mr. Simms is held in his city.

"Mr. R. B. Simms, a man whose strong civic spirit has been manifest in his work with the Spartanburg Water Works System, and who has proven himself a faithful servant in the interest of his fellow man. It is as superintendent of the Spartanburg Water Works that he has distinguished himself especially; and in this position he is continuing his work at this time and we hope for many years to come.

"When Mr. Simms was elected superintendent of the Spartanburg Water Works in 1920, the City of Spartanburg owned and operated a plant located at the end of North Church Street. Water was furnished by a small stream known as the Chinquepin. The water was insufficient and the plant became obsolete. In the year 1926 under Mr. Simms' supervision, the plant known as the South Pacolet

Robt. B. Simms

Filter Plant was erected on the Pacolet River. When Mr. Simms first took charge of the Spartanburg Water Works, the Spartanburg Water Works plant was valued at less than one-half million dollars. Today the plant has a valuation of over three and one-half million dollars, and plans have been drafted for the immediate expansion and development at a cost of an additional quarter of a million.

"A comparison of the average pumpage per day in 1920 with that of 1948 has increased from 1 mgd. to 8 mgd. The rates charged to the consumer compare favorably with any city in the south. The slogan is true 'Spartanburg Water Paces Spartanburg Growth.' There has never been a single case of sickness traceable to water furnished by the City, nor has there been a shortage of water during the severest drought season. The present system has been cited and pronounced by experts as one that the City should be exceptionally proud to possess. The government engineers, who inspected the plant before locating Camp Croft in Spartanburg, stated that one of the reasons why they had selected Spartanburg for the camp site was due to the abundance of pure water.

"Mr. Simms' ability has been recognized by his being elected as first president of the Southeastern Water Works Assn., and as first president of the South Carolina Water Works Assn., and he has aided in establishing the South Carolina Water Works and Sewerage School. Many articles have been published both in the press and in scientific magazines, commending Mr. Simms for his splendid accomplishments. National Associations have given him recognition—having appointed him one of five to serve on a committee to study plant operations and report his findings to the A.W.W.A. He has held many high offices in civic associations—serving as president of the Kiwanis Club, on the Board of Directors of the Y. M. C. A., and a deacon in his church; thus his sterling work and his many talents being available at all times to those who are trying to provide a better place in which to live. He has faith in Spartanburg and his recommendations for future improvements and developments have at all times had the backing of the Public Service Commission and through his farsighted policy the Water Works plant now stands as a monument to one who has had vision and the foresight to consummate what he believed to be in the best interest of all the citizens of Spartanburg.

"Rainbow Lake is a symbol of his civic pride and interest, and today thousands praise his name for the healthy enjoyment that they have received from this amusement park. Few men have been as active in furthering civic progress and developing Spartanburg and its institutions as much so as Mr. Simms."

There followed the official resolution spread upon the minutes of the Spartanburg Water Works.

Amendments Offered To Public Law 845

Amendments have been offered to the U.S. Pollution Control Act (known as Public Law 845) by congressman Crook of Indiana. Congressman Crook has introduced H.R. 4568 which would affect the provisions of Public Law 845, which was enacted June 30, 1948.

Under the present law, no action can be taken through the courts in water pollution control matters unless the pollution originating in one state is brought about by objectionable conditions in another state. Also, under Public Law 845, action through the U. S. Attorney's Office cannot be taken unless it was approved by the water pollution agency of the state in which the nuisance originated. The amended Bill (H.R. 4568) removes these so-called states' rights provisions and eliminates the provision for hearing for which there were specific regulations in the original law.

The intent of this amendment would appear to be to concentrate control of stream pollution in the U. S. Public Health Service and make it more difficult for the cooperative state programs to function.

Another provision in the amendment bill provides for federal aid in the form of loans to industrial enterprises for the construction of treatment works and the preparation of reports and plans in connection therewith.

Municipal Year Book 1949

The International City Managers Association has announced publication of the "1949 Municipal Year Book." This book contains sections devoted to governmental units, municipal personnel, municipal finance, municipal activities and directories of officials.

A copy of the Municipal Year Book may be obtained for $10.00, by writing the Municipal Year Book, 1313 E. 60th St., Chicago 37, Ill.

CORROSION CONTROL BY THRESHOLD TREATMENT*

by
JOHN H. WHITE†
Chemical Engineer
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APPROXIMATELY ten years ago the use of Calgon for corrosion control was introduced to the American public. The small amount of inhibiter required met the fancy of the water works men, and the use of Calgon for corrosion control has had quite general acceptance.

What Is Calgon?

Calgon is a glassy phosphate made of good grade raw materials and is also referred to as metaphosphate or sodium hexametaphosphate. The raw materials, usually phosphoric acid and soda ash, are fused at high temperatures and then quickly cooled to normal temperature. To obtain a product which is highly soluble and of the desired property, both temperature ranges must be closely controlled.

There is quite a difference between the true chemical and the physical reactions of Calgon, which at first may seem to be inconsistent. A strong solution of Calgon is corrosive to most metals, and it can even be considered a solvent. This is particularly true of iron and steel, and when the solution tank shows slight corrosion we are asked how this can happen when such a small concentration is being used to protect the system. However, the dilute solution loses this chemical solvency which will be gone into later in more detail and assumes surface active properties which result in the laying down of the protective film. It is these physical or surface active properties of Calgon in which we are primarily interested as water works men.

Calgon is being used to prevent the laying down of calcium scale in hard water districts, but in New England where waters are relatively soft, little use of this property is anticipated.

Another use is for iron control in well water supplies containing ferrous iron which later precipitates on standing or in the presence of air. A number of systems in New England are using Calgon for this purpose and are obtaining clear, colorless water.

Corrosion Control

The main use, however, will be in corrosion control. Here we are using a principle almost as old as the use of metallic pipe itself. Most corrosion control depends upon the formation of a protective scale or film or of making a protective coating such as the metallic oxide more stable or adherent. These steps require the altering of the composition of the water itself, and particularly in the case of the protective scale close chemical control is required to prevent too rapid a build-up in the first part of the system and yet get some protection at the end.

From a practical standpoint such control becomes impossible and a compromise is necessary. Such a compromise is one which does not give the desired protection but which likewise does not result in plugging up the system too rapidly. Some protective coatings can be applied mechanically with the systems out of service or before the pipe is installed, and as these coatings are uniform in thickness and usually impervious to the water, protection is achieved for the life of the lining.

With Calgon a protective film is formed in the pipe. This film is one or two molecules thick and never grows any thicker. Therefore, it forms uniformly throughout the system and being impermeable gives very good protection not only in the main but in the consumers' piping as well. The control is quite simple and in most cases once the feed is established an occasional check of the residual Calgon at the ends of the system is satisfactory. The small quantity of Calgon required does not alter the taste, odor, color, hardness, or pH value of the water. Likewise the cost over a long period of time seems comparable to the cost of coating mechanically installed in a system.

Factors Involved

One factor involved in applying Calgon to a distribution system is the flow or rate at which the Calgon is supplied to the metal surfaces. The lower the flow through a given distribution system, the higher the Calgon concentration should be to insure maintenance of the protective film. This is a very definite relationship and it has been shown that if ten pounds of Calgon per day will protect a system at a certain flow the same quantity of chemical will protect the system should the flow increase fifty per cent. On the other hand if the original flow should be decreased fifty per cent, it is quite likely that ten pounds of chemical will be required per day, all other factors remaining the same.

A second factor, that of surface of the system, fits right in with the flow factor, as, of course, the Calgon requirements would be based on a ratio between the flow and the surface involved. The surface of the system, however, would include not only the metal but the presence of rust and other suspended or dispersible solids that are present in the system. With rust and tuberculation in a system a higher feed of Calgon would be required at the beginning, and perhaps flushing should be employed during the starting up period to remove such of this material as is dispersed by the chemical.

A third factor involved in corrosion control is the presence of various salts in the water. From a practical standpoint this factor is taken care of quite satisfactorily, but by understanding the principle involved a better understanding of the formation of the protective film will be obtained. This protective film, which is depended upon for corrosion control, will not be formed in a distilled water system. However, upon the addition of calcium salt to the distilled water the protective film will form and can be maintained. Other salts such as those of iron react similarly. As calcium salts are present in natural waters this factor does not have to be considered unless excessively high feeds are contemplated, inasmuch as sufficient of these salts will be present to satisfy the requirement. It is only necessary to have the calcium content of the water one-quarter that of the Calgon concentration to obtain a good protective film formation. Thus with a normal feed of 2 ppm. of Calgon, the calcium (as Ca) content of the water would have to be at least 0.5 ppm. However, to feed 200 ppm. of Calgon for rapid film formation, the calcium

*A paper presented before the New England Water Works Assn. and here published by permission of the Association.
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content should be 50 ppm. This would have some value in protecting small systems where little circulation is experienced, or as will be described later for preforming the film when batch type corrosion experiments are to be made.

Calgon controls corrosion throughout the pH range normally encountered in water. Excellent corrosion control can be obtained and pH values as low as 5.0. A reduction in the amount of corrosion encountered can be obtained at pH values below this, but the efficiency seems to decrease. At pH values under 7 the corrosion that does take place is general in nature and will be neither noticeable nor troublesome. At pH values much above 8.0 any corrosion may leave an adherent deposit and is likely to be more localized in nature. Less corrosion will be encountered, however, with Calgon than under similar conditions in the absence of Calgon.

To Prevent Iron Precipitation

The use of Calgon for prevention of iron precipitation in well waters is probably the most spectacular use as far as the consumer is concerned. There are a number of well water supplies which contain small amounts of iron which can make the water look bad. It would be uneconomical, however, to construct an iron removal plant considering the quantity of water distributed from such wells. As a usual thing, the iron present in these well waters is in the ferrous state which precipitates on standing as hydrous ferric oxide. The same is also true where manganese is present.

Unlike corrosion control where the chemical did not have to be proportioned to the flow or the constituents of the water, in controlling iron and manganese there is a definite relationship between the amount of these salts and the Calgon required. For some industrial waters equal parts of Calgon to the total iron and manganese content will prevent precipitation and allow some color to develop. For domestic water, however, Calgon concentration of at least twice the iron and manganese concentration is advisable and four times the concentration is quite desirable when a minimum of color is desired in the hot water system. Water treated with four parts of Calgon for every part of iron and manganese can be used for normal household purposes without showing the presence of iron.

Likewise various persons have reported an improvement in the taste, although the absence of color may influence them greatly in this observation. There is no limit except economy to the amount of iron which can be kept in solution by Calgon. Numerous industrial installations are using Calgon to hold up 4 to 5 ppm. of iron, and there are quite a number of domestic water supplies where the iron content of 0.5 to 1 ppm. is maintained in solution.

In using Calgon for the prevention of iron and manganese precipation it is only necessary to use the proper quantity and to feed it to the system before air or chlorine is introduced. This usually means feeding the chemical to the suction side of the well pump if it is possible to do so. If wide variation in the flow is encountered the Calgon should be fed to take care of the maximum flow or else a proportioning system used.

To Test Effectiveness

It is possible to take two test tubes containing a water in question, drop a nail in each of them and a little Calgon in one, shake them up, let them stand over night, and observe the difference in the morning as a means of determining Calgon effectiveness. The best way to test the Calgon and sometimes the cheapest way is to add the proper amount to the system for a period long enough to obtain acceptable analytical results. By following the iron or dissolved oxygen content of the water at various ends of the system and comparing these results with the analyses of the water as it enters the system gives an excellent indication of how corrosion is being controlled. For larger systems where this would not be feasible a small quantity of the water can be treated and observations made either by using weighed sections of tubing or by measuring the iron or oxygen content before and after passing through this pilot plant type setup.

Inasmuch as flow is an important factor, an adequate amount of water should be used, and an attempt should be made to simulate the flow in the distribution system. A test like this carried out over an extended period of time will clearly indicate whether or not Calgon will give the desired results.

Batch Tests

Where batch type tests are desired it should be assumed that the test is to determine whether or not the protective film can be laid down on the type of metal under consideration. Such tests are usually for a relatively short period by their very nature. We suggest, therefore, the preformation of the protective film on the test specimens by agitating them in a solution containing several hundred ppm. of Calgon in about one liter of solution. In this case the calcium content of the solution should be at least one-quarter of the Calgon content. Either air or mechanical agitation may be employed.

The length of time required to obtain this film in equilibrium is not very great and approximately one hour should be sufficient immersion time. Thereafter the natural water should be used and any loss in weight of the specimen or any pickup of iron or other metallic salts by the water should be noted. The volume of water used for this test should be at least 20 l. and the Calgon concentration should be at least 5 ppm. Mechanical agitation should be employed although equally satisfactory results have been obtained using air for agitation; but the bubbling of air through the water will, of course, tend to change its properties.

If 5 ppm. or even 10 ppm. gives the desired result this does not mean that the concentration will have to be that high to achieve protection of the system. The Calgon feed should be such as to insure having 0.5 ppm. of unreverted phosphate in the water at the ends of the system. Where dead ends are not troublesome or where the water is not excessively corrosive and protection of the consumers' equipment is not to be considered, a slightly lower residual would be effective.

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Federal Bills Affect Industrial Waste Treatment Facilities

Congressman Byrnes of Wisconsin and Congressman Chatham of North Carolina have introduced two bills (H.R. 5089 and H.R. 5091) in Congress which make certain provisions for taxpayers to amortize, on a 60-month basis, expenditures for waste treatment facilities for industrial enterprises.

Under this bill, a taxpayer would be permitted to amortize on a 60-month basis for the treatment of industrial wastes and for other water pollution control facilities. The amendments to the Internal Revenue Bill would be applicable to facilities constructed, remodeled or expanded between the dates of June 30, 1948, and July 1, 1953.

REPORT ON GENERAL SESSIONS OF A.W.W.A. AT CHICAGO

THE story of the A.W.W.A. Convention in Chicago was started in our July issue, wherein was reported the affairs of the convention, the election of officers, presentation of awards, and other general information. In the August issue there appeared a report on the technical sessions of the Water Works Management Division and the Water Resources Division as well as the sessions of the Water Works Practice Committee and the Water Works Administration Committee, and one General Session (Wednesday morning—Water Works Ethics, British Water Industry, and Wisconsin Policies).

This present report covers the remainder of the General Sessions. The report on the sessions of the Water Purification Division appears elsewhere in this issue.

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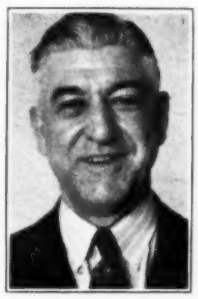

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Water Works Under City Manager Administration

WATER DEPARTMENT OPERATIONS UNDER CITY MANAGER ADMINISTRATION by Gerald E. Arnold, Director, Water Dept., San Diego, Calif.

Mr. Arnold stated that there are 877 American cities under the city manager form of government. Of these, thirty have populations in excess of 100,000. In preparing the paper, Mr. Arnold wrote to sixteen of these thirty cities, but his paper was largely devoted to the situation as it exists in San Diego.

In San Diego there are 26 other city departments which have some direct relationship to the water department; these include the Mayor and Council, the City Manager, the Auditor and Controller, City Attorney, Civil Service, Public Works, Public Buildings, Shops Division, Streets Division, City Engineer, Fire Department, Planning Dept., Park Department, Health Department, Police Department, and Purchasing Department.

Mr. Arnold explained how the water department is related to these various other departments and divisions of the city government. Cooperation between various departments is fostered by frequent conferences. Mr. Arnold cited an example of this cooperation, an incident in which a fire destroyed three water flumes, where the help of several other departments was utilized to restore service.

Mr. Arnold commented on the situations existing in other forms of municipal government and said he preferred the city manager form, as it permitted better cooperation between the water department and other departments. Until about two years ago, the San Diego Charter required that all water department earnings be turned over to the general fund of the city. This has been changed, and the water department can now build up a surplus for future capital expenditures.

In closing his paper, Mr. Arnold said, "to my mind, the one outstanding service that the A.W.W.A. can render to the water utilities of the nation, particularly those that are publicly owned, would be to engage in a campaign to rectify the situation of taking water department earnings for the subsidy of public improvements or the operation of other city departments."

In discussing Mr. Arnold's paper, **Reeves Newsom,** Village Manager, Scarsdale, N.Y., pointed out that his village is not included in the total number of cities mentioned by Mr. Arnold because it is a village and not a city, but it works effectively under the manager form of government.

In Scarsdale the Village Board also acts as the Water Board. It is composed of outstanding men in the community, is elected without any politics (all candidates are chosen by a community wide committee, and run on all political tickets). Candidates are chosen without their knowledge, and serve without pay. Tenure of office of the manager and other department commissioners is long. Franklin Henshaw (donor of the A.W.W.A. Henshaw Cup) was head of the Water Dept. for 20 years. Salaries are such as to attract and hold competent public officials.

Funds of the Water Dept. are kept completely separate from other funds. The department purchases purified water and sells it to consumers. No treatment is required; only pumping, storage and distribution. Taxpayers pay for fire protection service by a tax based on valuation of property (50 cents per $1000). Schools pay for water used inasmuch as they are a separate municipal corporation.

While this system works excellently in a community such as Scarsdale, its application to large cities does not seem likely, but there are any number of communities in the United States which could profitably study the functioning of the government of Scarsdale, N.Y.

Metropolitan Chicago

WATER SUPPLY PROBLEMS IN THE CHICAGO METROPOLITAN AREA by L. D. Gayton, Asst. City Engr., Dept. of Public Works, Chicago, Ill.

In the Chicago Metropolitan Area the municipalities bordering on Lake Michigan have a practically unlimited

water supply, but the inland municipalities have, for years, been faced with the problem of a continuously receding sandstone water level. This recession has necessitated the lowering of pumps, increased pumping costs, and in some cases, unsatisfactory water quality.

"For more than 40 years men have been studying ways to distribute Lake Michigan water throughout the metropolitan area. Principal obstacle to progress of the works is the difficulty of unifying the desires of the numerous communities involved, and the desire of each to avoid domination by a larger political agency."

Mr. Gayton presented the proposed plan, developed by Oscar E. Hewitt, Commissioner of Public Works of Chicago. This plan would cover 62 municipalities, and the water would be delivered at the boundary of each community. Within a circle of a 40-mile radius, there are 193 communities with a total estimated population of approximately 4,800,000.

The City of Chicago now supplies sixty communities and fifteen communities have their own supply from Lake Michigan. These supplies with that of Chicago serve approximately 91 per cent of the population of the metropolitan area. The proposal is to serve practically all of the remaining population.

Mr. Gayton also discussed the problem of air conditioning in the Chicago Loop Area. At the end of 1932 there were 5200 tons of air conditioning capacity. Nine years later this figure had risen to 21,468 tons, an increase of more than 300 per cent. At the end of 1948 the tonnage had increased to 28,641 tons or an increase of 33 per cent during the war and postwar years. Peak consumption of this tonnage would amount to approximately 62 mgd. Actual peak consumption including domestic uses has reached 75 mgd. for the Loop Area.

Total air conditioning tonnage installed in the city is more than 125,000 tons, which if operating at 100 per cent of capacity, would produce a peak demand rate of 270 mgd. Tremendous increases in installed capacity have taken place in the Loop and elsewhere, but it was stated that present pumping capacity is sufficient to supply this increase in demand for many years to come. All water for air conditioning purposes is supplied through meters at the regular metered rate of 60 cents per 1000 cu. ft., with an 8 per cent discount for prompt payment. Thus the water is sold for 7.36 cents per 1000 gal., probably the lowest rate of any city in the country, a fact that probably accounts for the lack of water conservation devices installed on air conditioning equipment in Chicago.

The speaker also mentioned the increasing inadequacy of the sewers in the central business district, a condition that is being aggravated by the increase in air conditioning equipment installations.

Mr. Gayton concluded his paper with a discussion of the lowering of the ground water level in the area in and about Chicago. This water level recession has been progressing at from five to eight feet a year. Such recession obviously increases pumping costs and it appears only logical that communities with this problem will have to obtain water from Chicago in the future.

Report on Installing C. I. Mains

STANDARD SPECIFICATIONS FOR THE INSTALLATION OF CAST IRON MAINS by Joseph P. Schwada, City Engineer, Milwaukee, Wis.

This paper by Mr. Schwada was a discussion of some of the more controversial points in the A.W.W.A. Committee report on Specifications for C.I. Main Laying. Mr. Schwada is chairman of that committee.

Mr. Schwada pointed out that while the standard specifications could be used in their entirety for any project, they must of necessity have attached an addendum prepared for the particular project by the engineer in charge. The new specifications contain an outline of the items that should be considered for inclusion in this addendum.

Mr. Schwada's paper did not detail the provision of the specifications as set forth by the committee but concentrated on the items of most vital importance in assuring a satisfactory job and also on those items on which there had been a divergence of opinion.

In short, the paper covered the following topics: Responsibility of the Engineer, Excavation and Preparation of the Trench, Backfilling, Laying Pipe, Blocking, Jointing, Hydrostatic Tests, Removal, Restoration and Maintenance of Surface, and Disinfection of Mains. In concluding the discussion of these points, Mr. Schwada said that he hoped that approved specifications would shortly be forthcoming after the committee report had been passed on by the Board of Directors.

Cement For Main Jointing

EXPERIENCES WITH CEMENT AS A JOINTING MATERIAL by Dale L. Maffitt, Gen. Mgr., Des Moines Water Works, Des Moines, Iowa.

Mr. Maffitt said that of the several jointing materials used for bell and spigot cast iron water pipe joints, cement is probably the least publicized. Portland cement for making joints is mixed only with water in such amounts as to produce a crumbly, moist mixture which is put into the bell of the pipe in such a manner that the neat cement may be caulked into place in layers until the bell is completely filled. The cement forms an extremely dense mass which becomes very hard and waterproof after curing.

Portland cement was first used for this purpose between 1879 and 1889 in Redlands and San Jose, Calif. Mr. Maffitt reviewed briefly the history of cement joints elsewhere and told of the experiences at Des Moines where 76 out of 452 miles of mains are laid with cement joints, which apparently are comparable to all other types of joints.

In the discussion of this topic, the first speaker was **Laurance E. Goit,** Ch. Engr. and Dep. Gen. Mgr., Dept. of Water and Power, Los Angeles, Calif. Mr. Goit reviewed the experience with cement joints in some California cities and spoke of certain precautions that must be taken in the general laying of the pipe line and in making the individual joint.

In particular, Mr. Goit pointed to the necessity for the pipe to be laid solidly on a trench bottom that will not settle. Where there is a wide range of temperature, undue stress on the pipe line can be eliminated by using a lead joint at intervals of about 500 ft. Mr. Goit believes that cement joints are of a definite help in combating stray currents in the ground, inasmuch as the pipe line is broken up into small segments which prevent the collection of large amounts of current for discharge at any one point.

An inquiry by Mr. Goit of 23 communities in the west indicated that 19 regularly use cement joints. Of these 9 use hemp or yarn, 10 do not. The average length of time that these communities have been using cement joints is 35 years, and the proportion of leaking joints has been under 1 per cent. A majority of the water departments make cement joints without packing of any kind. Concern about thermal expansion damage is about evenly divided, but nearly all use lead joints where gate valves are inserted in the line. Cement joints are cheaper

than other joints, according to Mr. Goit, and while experiments have been made using cement and sand mixtures, there appears to be no economy in this practice. In closing, Mr. Goit listed ten points that are important to the proper technic for making cement joints.

George W. Pracy, Gen. Mgr. and Ch. Engr., Water Dept., San Francisco, Calif., reviewed the paper which he had presented on this subject in the July, 1920, issue of the *A.W.W.A. Journal*. This paper discussed making the joint, amount of cement used, cost of cement joints, leakage through cement joints, flexibility of cement joints, and repair to cement joints.

Experiences with cement joints in Miama, Fla., were reviewed by **C. F. Wertz,** Res. Engr., Dept. of Water & Sewers, Miami, Fla. Between 1932 and 1942 practically all joints were made with cement. Since that time most of the joints have been made with a sulphur jointing compound, principally because of the tight joints obtained at lower costs of installation. While there has been an increase in unaccounted-for water, Mr. Wertz emphasized that this followed an increase in water pressure, and apparently had nothing to do with the type of jointing materials used.

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Report on Fluoridation

(The following report on the General Session of Wednesday afternoon was prepared by Harry A. Faber, Research Chemist, The Chlorine Institute, New York City.)

THE FLUORIDATION OF PUBLIC WATER SUPPLIES, a committee report by Dr. A. P. Black, committee chairman.

This report which has been approved by the A.W.W.A. Board of Directors, consisted of a statement of recommended policy and procedure. This policy statement was briefly reviewed in the July issue of *Water & Sewage Works*, but because of the importance of the subject, the following resumé on the committee report is included here.

There is sound evidence that 50 to 65 per cent less tooth decay occurs in a community where the public water supply naturally contains fluoride (1.0 to 1.5 ppm.), than in a community where the public water supply contains little or no fluoride. Would tooth decay be reduced if fluoride is artificially added to the water? This proposal is now being tested in several communities in the United States and Canada. The question cannot be answered, however, until children in these communities have used the treated water for eight years (the enamelification period of the teeth).

Meanwhile, the water works industry is being confronted with demands for the adoption of fluoridation. The policy advocated in this committee report is divided into two categories, experimental and empirical. Experimental applications include communities where the fluoride-dental caries hypothesis is verified experimentally by scientific methods; a "control" city must be included in the study, and specialized technical personnel must be employed. Empirical applications include those where, while awaiting the results of experimental applications, the community is willing to provide the cost of fluoridation for the purpose of giving anticipated protection to the oncoming generation of children at the earliest possible time. With reference to recommended policy, the report states:

"In communities where a strong public demand has developed and the procedure has the full approval of local medical and dental societies, local and state health authorities, and others responsible for the communal health, the water departments or companies may properly participate in a program of fluoridation of public water supplies."

The report also provides an excellent statement of recommended practice, details of which were published with this committee report in the July issue *A.W.W.A. Journal*. Briefly, the utility will be relieved of responsibility for adoption of fluoridation; it will follow approved methods of application, control and analysis; and the cost of the treatment will be properly allocated.

That the subject of fluoridation is of great present interest was evidenced by the discussion following presentation of this report. **N. J. Howard,** Dir. of Water Purification, Toronto, pointed out that his city has a population of 700,000 but that only 47,000 children (less than 7 per cent of the population) would be benefitted by fluoridation. He estimated the cost in Toronto would be $100,000 per year, or 15 cents per capita. Professor Black agreed that fluoridation is, in one sense, a wasteful procedure—but he called attention to the fact that the same criticism applies to chlorination and softening of municipal supplies. A representative of the Maryland State Health Department reminded Mr. Howard that the 7 per cent protected population would increase each year and would become 100 per cent in time.

C. R. Cox, Chief, Bureau of Water Supply, New York State Dept. of Health, compared the earlier concept of "medication" with what might now be considered the restoration of a deficient natural element. He noted that the cost of water supply fluoridation is less than that of topical application, and only children are benefitted by the latter method. Even when fluoridation becomes accepted practice, some small water supplies cannot be safely fluoridated—and there will be need for topical application methods for rural populations.

O. E. Brownell, Div. of Water Supplies, Minnesota Dept. of Health, stated the policy of his State would be to permit empirical applications under proper control. **B. C. Nesin,** Dir. of Labs., New York City Dept. of Water Supply, asked if any con-

sideration had been given to the use of fluoride compounds other than sodium fluoride.

Mystery of Polio Virus

RECENT RESEARCH ON THE TRANSMISSION OF POLIOMYELITIS—WITH PARTICULAR REFERENCE TO THE HYPOTHETICAL INVOLVEMENT OF WATER SUPPLIES by Kenneth F. Maxcy, Prof. of Epidemology, Johns Hopkins Univ., Baltimore, Md.

The water works profession is vitally concerned with the supposed involvement of public water supplies in the spread of infantile paralysis. Accordingly, the review of this subject by Prof. Maxcy was awaited with much interest.

Dr. Maxcy first emphasized that the exact manner of transfer of the virus is not clear; the ratio of inapparent infection, or carriers to recognized cases may be of the order of 100 to 1. It is established that some form of personal contacts is necessary to explain the principal mode of infection. Investigations have now demonstrated the virus to be widely distributed in human excrement, and active virus has been recovered many times from raw sewage, especially during epidemic periods. The question naturally arises, can the virus grow and multiply in sewage? Apparently not; the virus concentration depends upon fecal contribution and decreases with age of the sewage.

The next question would logically be, can sewage pollution of a public water supply be a means of spreading the disease? While relatively few studies have attempted recovery of the virus from water, there is no present evidence that public water supplies are implicated in the transmission of poliomyelitis. A number of laboratory investigations, however, have been made to determine the effectiveness of conventional methods of water purification in removing or inactivating the virus. Exploratory experiments indicate aeration, coagulation, and filtration to be inadequate for this purpose. Chlorination is the most promising treatment method; it has been demonstrated that a poliomyelitis virus can be inactivated in water by chlorination which provides 0.2 to 0.35 ppm. free available chlorine residual after 30 min. contact time. When chlorination provides less active combined available chlorine residuals, either higher residuals or longer contact periods are required.

Dr. Maxcy questioned whether infective amounts of poliomyelitis virus ever reached humans through potable water. The hypothesis, that they do, is not consistent with epidemiological evidence. The treatment of water supplies by free residual chlorination, a practice now followed by many municipalities, appears to constitute an adequate safeguard. On the basis of present evidence, no public water supply has been implicated in the spread of infantile paralysis.

Following the presentation of this paper, **L. H. Enslow,** President A.W.W.A., expressed the appreciation of the Association to Professor Maxcy for his extremely valuable contribution to a better understanding of the subject.

J. E. Kerslake, Supt. Filtration, Milwaukee, raised the question of polluted bathing beach water as a means of spreading poliomyelitis virus. Prof. Maxcy pointed to two factors involved in this possible vector: sewage pollution and direct transmission from person to person.

R. J. Faust, Chief, Div. of Water Supply, Michigan State Dept. of Health, discussed the wide adoption of free residual chlorination of water supplies in Michigan. The practice was furthered, beginning in 1944, by the State Dept. of Health in an effort to reduce the incidence of poliomyelitis; control of this disease by improved chlorination of public water supplies has been unsuccessful. There are many unsolved problems in connection with this disease, such as findings that as many as 90 per cent of a population may have poliomyelitis without the development of many paralytic cases. At present, the lack of a sensitive test for the presence of the virus of this disease in water is a considerable handicap.

Water Quality

PANEL DISCUSSION: WATER SUPPLY QUALITY, including the following speakers:

Arthur D. Weston (Moderator), Chief San. Engr. and Director, Div. of San. Eng., State Dept. of Health, Mass.

Arthur N. Beck, Chief Engr. and Director, Bur. of San., State Health Dept., Ala.

Charles R. Cox, Chief, Water Supply Sec., Bur. of Env. San., State Dept. of Health, N. Y.

T. A. Filipi, Director, Div. of San., State Dept. of Health, Neb.

David B. Lee, Chief San. Engr., State Board of Health, Fla.

Arthur D. Weston described the pollution of ground water supplies in his State as "not serious," but pointed to the need for correction of pollution problems in surface supplies. He reviewed the influence of population on water quality, with reference to the lowered proportion of typhoid carriers in existence today, and stated that our present bacterial standards of quality may be unnecessarily rigid.

Weston also commented on the maintenance of higher chlorine residuals to control organisims producing gastroenteritis, stating that this practice removed slime coatings from lead service pipes and could thus cause an increased solubility of lead in the consumers' water supply. He questioned the justification of this practice in view of the expense of replacing lead services. In the belief that the time has come to evaluate sanitary engineering practices as they affect public health, Mr. Weston emphasized the tenor of his paper as "standards and requirements should not be unreasonable."

Arthur N. Beck gave statistics showing the increase of public water supplies in his state to be from 81 in 1920 to 310 in 1949; they now serve 80 per cent of the population. In the same period typhoid fever has been reduced 98 per cent; gastroenteritis has been reduced 80 per cent. The major problem at present is the lack of investigations or improvements in engineers' plans for new works. The water supplies of the state, with the exception of a few small supplies, are in a safe and adequate condition; however, technical personnel is scarce, and direction of plant operation by state engineers is essential.

Chas. R. Cox summarized information from summer resorts in New York State where 66 per cent of the gastroenteritis outbreaks of the U. S. are reported to occur. He indicated that this disease may be generally prevalent in the nation but to be not reported. Endemic gastroenteritis is now the most common disease in his State, but typhoid fever is practically non-existent. The "virus" type of gastroenterits is the subject of laboratory study, particularly with reference to its chlorine resistance. Mr. Cox concluded that the prevention of structural failures must be given increased attention, water rates must be adequate to permit technical improvements, and—at the present point of diminishing returns—eternal vigilance is necessary.

T. A. Filipi protested curative measures as less desirable than preventive measures. Monthly sampling of a supply, where potential contamination exists, cannot certify to safety of the supply. Excessive pollution and inadequacy of treatment combine to present a serious hazard. Bad re-

ports of bacteriological quality may be discarded, and failure of treatment processes may be denied. He called for thorough cooperation in the protection of water supplies, the proper use of facilities, and the elimination of potential hazards.

David B. Lee discussed problems of protecting ground water supplies (these constitute over 90 per cent of the supplies in his state). His paper indicated the lack of public recognition of water works officials to be an outstanding problem. Great advances have been made in Florida as a result of training operators in short school programs.

In the open discussion following presentation of these papers, **H. H. Gerstein** (Chicago) decried any suggestion that water of lower quality be considered acceptable because of the decrease in typhoid fever. He pointed out that, while there is little smallpox in the U. S., no suggestion has been made to relax vaccination practices. **E. A. Schmitt** (Washington, D. C.) contended that state health authorities should openly report deficiencies in water supplies when they exist as a threat to the public.

John R. Baylis (Chicago) expressed disappointment at the complacent attitude of public health officials. He claimed they no longer provided guidance toward higher standards of water treatment. In reply, Mr. Weston said a great need exists for sanitation research. Mr. Cox called attention to human fallibility and the breakdown of equipment; some means must be found to increase the competence of water works operators.

Transmission Line Failures

MINIMIZING SERVICE INTERRUPTIONS DERIVED FROM TRANSMISSION LINE FAILURES by W. W. Brush, Editor, *Water Works Engineering*, New York City.

Mr. Brush pointed to the importance of continuity of service and commented on the five occurrences where transmission lines had failed in the past year. The reports had been taken from the National Board of Fire Underwriters in four instances. In E. Chicago, Ind., an outage of eight hours was caused by a flood in a pump building with nine electric pumps being put out of commission due to a thirty-inch main break. The principal lesson learned here was that where electricity is the sole source of power, provision should be made to prevent any possible flooding of pumping stations.

In Columbus, Ohio, a 36-inch main break put the service out for 2 days. At Indianapolis, Ind., a 36-inch main break on the pumping station grounds could be easily located as to position but it was impossible to tell which of two parallel mains had broken. Flooding of the grounds made it hard to find the proper valve to shut off the main. Here again the Fire Underwriters recommended that provision be made to prevent flooding of grounds and stations, and also for finding lines.

Two other places suffering main breaks were Albany, N.Y., and Taunton, Mass. The Fire Underwriters point out that weaknesses do exist, according to Mr. Brush. Conditions in every water department should be analyzed in reference to these possible weaknesses. A check list is available from the National Board of Fire Underwriters.

This paper was discussed by **S. Logan Kerr,** Cons. Engr., Philadelphia, Pa. He said that there are many factors that cannot be checked in advance of a main break. On the other hand, every water supply should study water hammer and surge control devices. Mr. Kerr cited several instances in which such studies had indicated the need for surge suppressors. These studies can be made in the original design, and by computations the proper design can be arrived at. No single device is a panacea for all problems or conditions.

According to Mr. Kerr, theory has been found to agree with fact, and the time and effort in a surge study is less expensive than a possible main break.

Also discussing this paper was **Harvey T. Munn,** Hydraulic Engr., National Board of Fire Underwriters, Chicago, Ill. Mr. Munn emphasized the need for duplicate transmission lines and valves, and the need for preventing flooding of stations. Ample elevated tank storage should be provided, and good records of operation are essential. Inspection of valves should be made at least once yearly and there should be ample provision for communication in case of main failure.

D. B. Lee
Ch. San. Engr.
Fla. H'lth Dept.
Jacksonville, Fla.

W. W. Brush
Editor
Water Wks. Engr.
New York City

And Still More Programmers

Paul Weir
Gen. Mgr.
Water Dept.
Atlanta, Ga.

M. B. Cunningham
Supt. & Engr.
Water Dept.
Oklahoma City, Okla.

N. S. Bubbis
Cons. Engr.
Ross & Tecumseh
Winnipeg, Can.

C. A. Hechmer
Dept. Engr.
Wash. Sub. San Dist.
Hyattsville, Md.

Modern Billing Methods

ATLANTA ADOPTS MODERN BILLING METHODS AND EQUIPMENT by Paul Weir, Gen. Mgr., Water Dept., Atlanta, Ga.

By means of slides showing equipment and records, Mr. Weir told the story of how Atlanta had switched from hand billing to machine billing. The billing machines are rented at $900 a month from International Business Machines, Inc. It required three months to train the local staff to handle the machines and five months to make the switch but the efficiency of operation and lowered cost were worth the effort and the cost of the machines. One of the innovations was to eliminate bills and substitute in place thereof a post card, printed in attractive blue ink on white stock. Each card carries a message from "Willing Water."

Rate Structures

PANEL DISCUSSION: RETHINKING WATER RATE STRUCTURES, including the following speakers:

Moderator: L. E. Ayers, Cons. Engr., Ann Arbor, Mich.

Chas. H. Capen, Chief Engr., North Jersey Dist. Water Supply Comm., Wanaque, N.J.

E. F. Dandridge, Director of New Business and Statistics, Dept. of Water and Power, Los Angeles, Calif.

Richard H. Ellis, Hydraulic Engr., Factory Mutual Engr. Div., Boston, Mass.

Melvin P. Hatcher, Director, Water Dept., Kansas City, Mo.

A. P. Learned, Prin. Engr., Black and Veatch, Cons. Engrs., Kansas City, Mo.

Reeves Newsom, Village Manager, Scarsdale, N.Y.

Hal. F. Smith, Sr. Adm. Asst., Dept. of Water, Detroit, Mich.

In opening the panel discussion, **L. E. Ayers** stated that there is a wide diversity of opinion in regard to rate schedules. It has been the purpose of the committee to try to arrive at a sound approach to the subject. In developing the panel discussion, all participants were asked five questions which stemmed from the one question "How much revenue should a water works receive?"

E. F. Dandridge stated that in his opinion the total financial requirement of a utility is a function of the revenue and vice versa. It is necessary to determine costs, needs, maintenance, etc. over a period of time. Revenue should provide economic and efficient operation, maintenance, and betterment.

Reeves Newsom said that it was customary to figure on retiring bonds so that the borrowing power is renewed. Often refunding and paying interest will cause the payment of interest to be more than the principal. He cited a case where because of the interest paid, the actual cost of the capital improvement was nine times the original cost. Shifting to pay as you go is a far sounder policy, but is hard to do unless the proper rates obtain. In such a pay-as-you-go plan, provision should be made for depreciation and replacement when needed.

A. P. Learned emphasized the fact that a utility should have enough income to cover the cost of service, operation, maintenance, depreciation, taxes, and debt. Private utilities do not have the amortization and debt service charges that public utilities do.

R. H. Ellis commented on the amount of income needed for fire protection, saying that while it certainly should be considered there is no general formula. Less than forty per cent of the communities in the country collect for fire protection service. Where they do, the collection varies over wide limits. The problem is confused by tax payment or exemption in many cases. Mr. Ellis pointed out that it is growing more and more common to have a combined water and sewer service charge, and he asked the question, "Why not have a water and fire service charge?" (See report above about Scarsdale, N.Y., where such a service exists).

M. P. Hatcher believes that the ready-to-serve charge has no part in a rate schedule for small consumers; he believes that there should be load factor studies made, with a high demand charge for lawn sprinkling. Mr. Hatcher further believes that a minimum charge is preferable to a service charge or a ready-to-serve-charge.

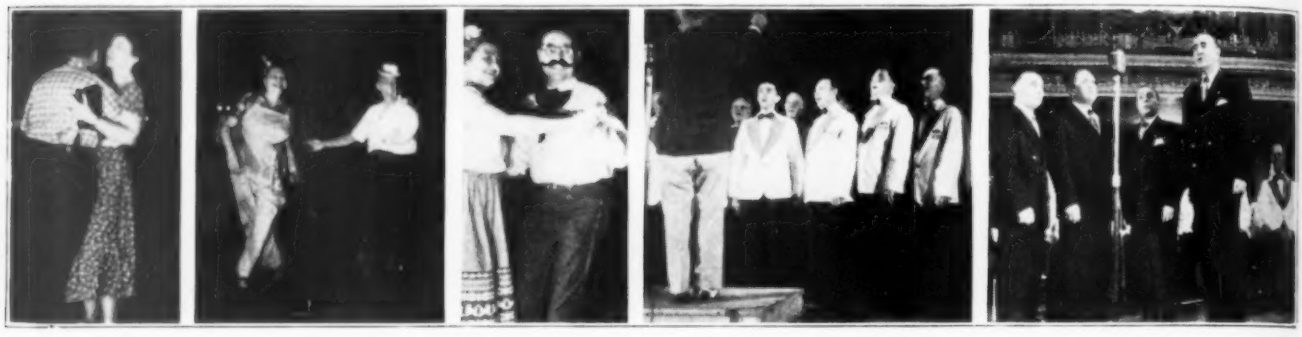
Mr. Jacobs' paper was read by **Myron Mansfield,** Cons. Engr., Pittsburgh, Penna. Mr. Jacobs believes in a ready-to-serve charge that is different from a minimum charge. Costs can be determined on the basis of capacity (all supply and operation costs), consumers' costs, and output costs. Rates can be based on a proper allocation of these costs, and a ready-to-serve charge can be easily determined from the capacity and consumers' costs.

Chas. H. Capen stated that slides, steps, and blocks are not the same thing when one is talking about rate schedules. A slide is a sliding scale rate, in which the first slide usually allows the consumer twice what he normally uses. Some utilities have ten, some have five, or six slides. The 1923 report of the committee on this subject recommended not more than three or four slides. Mr. Capen believes that that idea is still good.

Hal F. Smith commented on the application of the water rate formula proposed by the Michigan Section A.W.W.A. This formula appeared as a report published in the March, 1949, issue of the *A.W.W.A. Journal*. Mr. Smith told how this formula worked when applied to the Detroit situation. In order to apply the formula to the Detroit water supply costs, it was necessary to distribute operation and maintenance expense, debt service, and amounts expended or set aside for improvements and extensions to the classifications of the formula, which are as follows: (1) Commercial, (2) Meters and Services, (3) Production, (4) Transmission, and (5) Distribution among different sizes of mains (above and below 6 inch).

Mr. Smith found that when the formula was applied to Detroit data, good agreement was obtained with actual income. Mr. Smith said it was a matter of opinion or point of view whether this agreement of formula and actual rate proved that the formula is right or that the Detroit rate is right.

Following the prepared papers, the chairman of the panel called on **Samuel A. Greeley,** Cons. Engr. of Chicago, who heads the joint committee of the A.S.C.E. and Amer. Bar. Assn. on water and sewer rates. Mr. Greeley reported that the purpose of the committee was to bring order out of chaos. Problems that are causing confusion include this example: Where the operation of the water utility is paid entirely out of taxes, the water utility doesn't receive a fair contribution from large users. On the other hand, where the water rates pay costs of operation and turn funds over to the general fund, then the large user feels that he is being unduly burdened. Mr. Greely also spoke briefly on enabling acts and what they permit, and on



Hayseed Hullabaloo—And Some Real Barber Shop Harmony

what should be the fundamental relation of taxes to water rates. There are seven organizations cooperating in this study, and the third meeting of the committee is scheduled for September of this year.

The General Session of Thursday afternoon covered radio, automatic equipment, steel pipe inspection, and pumping equipment history. This section of the report was prepared by F. E. Dolson, Chief Dist. Engr., St. Louis County Water Co., University City, St. Louis, Mo.

Use of Radio

PANEL DISCUSSION: WATER DEPARTMENTS' USE OF RADIO included the following speakers:

M. B. Cunningham, Supt. and Engr., Water Dept., Oklahoma City, Okla. (Moderator).

N. S. Bubbis, Engr. of Water Works and Sewerage, Ross and Tecumseh, Manitoba, Can.

Adolph Damiano, Distr. Engr., Hackensack Water Co., Weehawken, N.J.

Frank E. Dolson, Chief Distr. Engr., St. Louis County Water Co., University City, Mo.

Carl A. Hechmer, Dept. Engr., Maint. and Oper., Washington Suburban San. Dist., Hyattsville, Md.

First speaker on the panel was **Carl Hechmer,** who spoke on "How to Make Application and Obtain F.C.C. License to Operate." Mr. Hechmer said that new F.C.C. rulings considerably alter requirements and procedures for obtaining required license to operate mobile radio units. The new rulings which are set forth in detail in the May 6 issue of the *Federal Register* are not covered in this paper.

The first step in securing a license to operate radio equipment is to obtain applicable rules and regulations from the F.C.C. The second step is to file a proper application on a form which is provided for that purpose with the F.C.C. It is necessary to give specific data such as location of land station, antenna structure, air port location, etc. Close proximity of an air port may require an additional application, should the antenna structure exceed 150 feet or be within three miles of an air port.

Approval of the application by the F.C.C. will allow the purchase and installation of necessary equipment.

A separate application must be submitted if mobile units are to be used.

It was pointed out that unless the water works industry takes increased interest in mobile radio service they may find that the more desirable frequency channels have been allocated to other groups.

L. E. Ayers
Cons. Engr.
Ann Arbor
N. J.

C. H. Capen
Ch. Engr.
No. Jer. Wt'r Comm.
Wanaque, N.J.

R. H. Ellis
Hyd. Engr.
Fact. Mutual
Boston, Mass.

M. P. Hatcher
Director
Water Dept.
Kansas City, Mo.

Panel Discussion—Water Rate Structures

Reeves Newsom
Village Mgr.
Scarsdale
N. Y.

Hal F. Smith
Sr. Adm. Asst.
Water Dept.
Detroit, Mich.

New regulations covering utility radio service allow unlicensed personnel to operate both the land and mobile stations. Repair, maintenance and adjustment of either base or mobile units require the services of a first or second class radio telephone operator's license.

"Selecting Equipment for Individual Needs," was the topic of the second speaker, **Adolph Damiano.** F. M. or Frequency Modulated radio systems are becoming established as a superior medium of sound broadcasting. It is virtually free from static and other forms of interference and is capable of high fidelity reproduction of sound. Because of advancements in F.M. systems it appears that A.M. may be relegated to a comparatively minor role in the future. F.M. differs from A.M. in that the frequency of the carrier wave is varied by the impressed signal. In A.M. systems the carrier wave is continuous and has the signal superimposed upon it.

There are three basic systems:

1. A one-way system with a fixed land station to mobile units that have no talk back facilties.
2. Two-way systems in which the land and mobile stations are able to communicate with each other.
3. Three-way systems in which the mobile stations may contact one another in addition to two-way service.

Power utility radio service is classified within industrial radio service and includes in addition to the utilities other users such as geophysical, provisional, motion picture and petroleum pipe line. Because of the great demand for frequency assignments within the available channels it is recommended that groups contemplating radio service should seek the advice of the Regional Frequency Coordinating Committee in order that there be minimum interference between closely adjacent systems.

In selecting the frequency for a particular need, the size of the area to be covered, the nature of the terrain, and the height of available antenna sites should be considered.

Radio communication is a fast, safe and practical means for maintaining contact with the inspectors and repair crews, and it offers an unsurpassed opportunity for improving public relations.

F. E. Dolson spoke next on "Telephone Type Equipment,"

Radio wire service communication, known as radio telephone service, is available from a common carrier on a subscription basis.

Four types of such service can be obtained:

1. General
2. Dispatching
3. Selecting
4. Highway

All except the signaling service are of the two-way type wherein the mobile unit can talk back to the land station.

In radio wire service it is possible to contact mobile units by the use of familiar telephone units. Messages are transmitted from these units by wire to a transmitting station which is operated and maintained by the common carrier. From the central

transmitting station, messages are sent by air to the mobile station. The central stations are equipped with a 250-watt transmitter and the mobile units are generally equipped with 30-watt transmitters. This system enables coverage of a 20-mile service area with very few blind spots. The service is available to anyone who cares to subscribe and for that reason utility messages are subordinated, in many cases, to less essential messages by other subscribers who have equal privileges for channel usage. Lack of priority for essential messages should be considered when selecting radio telephone service.

Selective signaling in radio telephone service is one of its real advantages. Another advantage is the fact that supervisory personnel can contact mobile units directly from their office or home by the use of an ordinary telephone outlet.

The high cost of this service is lessened to some extent by: 1. Less stand-by time by crews receiving orders, 2. Faster and more accurate material deliveries, 3. Better dispatching, and 4. Reduced telephone expense.

Radio telephone service merits consideration as a satisfactory substitute for independently owned radio systems.

Last speaker on the panel was **N. S. Bubbis,** who spoke on "Experiences in the Use of Mobile Radio Equipment and Its Value."

The City of Winnipeg, because of its geographical location, has been very radio conscious. Arrangements were made in February, 1934, with the City Signaling Department for installation of a radio receiver in a water works emergency or trouble truck. In 1939 the system was changed to a two-way communication on a frequency of 45.5 megacycles.

In September, 1946, approval was obtained for the operation of a joint system with the Winnipeg Fire Dept. The City of Winnipeg believes that their expenditures have been fully justified. It is difficult to evaluate such service on a dollar and cents basis, although the saving resulting from one major emergency in reduced property damage may more than pay the entire carrying cost for some time.

Detailed logs of messages concerning leak emergencies in the City of Winnipeg reveal the rapidity with which emergencies can be handled.

In the April and May, 1948, flood the radio service was an invaluable aid in dealing with the many problems caused by the emergency conditions.

At the present time the system is still jointly operated with the fire department; however, increased usage by the water department may make it desirable in the future to obtain an individual channel.

Automatic Equipment

"Advantages and Limitations of Automatic Equipment for Water Works" by V. C. Lischer, Horner & Shifrin, Cons. Engrs. St. Louis, Mo.

Automatic control can be defined as a process or device that eliminates or reduces "necessary" manual effort. The word "necessary" is essential to the definition. Improved methods of automatic and semi-automatic controls have, in many cases, made it possible for water utilities to increase the quality of the product and service without additional cost to the consumer.

Automatic control involves a measurement and a regulation, each of which is performed by separate devices. There must be a connecting link between the measuring device and the regulator. The link may be mechanical, hydraulic, pneumatic or electrical. Distance limitation of the various types of linkages is a prime factor in the selection of the automatic control: Mechanical links, about 50 ft.; hydraulic links, 200 to 500 ft.; pneumatic links, approximately 1000 ft.; electrical links up to 1000 or more miles.

Mr. Lischer outlined the five more important types of electrical links and mentioned four miscellaneous electrical means of transmission. Among the advantages of automatic control are: (1) Improvement of quality of product and service, (2) Improvement in quality of personnel (3) Improvement in reliability, and (4) Reduced cost. There are, however, some limitations of which the designer should take cognizance.

If a fully automatic system is contemplated, properly designed interlocks should be provided which will shut down the entire plant or place in service other standard units in case of failure of any component.

Centralized control, together with semi-automatic control, offers great opportunity for saving in cost and improvement of personnel. Recording instruments provide an effective means of checking on the performance of the control.

Saving resulting from the use of automatic control equipment very often makes possible the employment of a better trained personnel. Automatic control should never be installed simply for the fact of making things automatic.

Steel Pipe Inspection

Steel Pipe Inspection—Ten Helpful Hints, by Edward Clark, Chief Engr., Dept. of Water Supply, New York City.

New York City has approximately 105 miles of steel pipe which form secondary arteries in the City distribution system. Steel pipe has been used in all sizes between 30 and 84 in. in diameter for a period of over 40 years. In order to insure properly constructed steel lines the City has deemed it of primary importance to install adequate inspection procedures.

Inspection Procedure: Where impractical to assign an inspector at the

Inspection Trip So. Dist. Filtration Plant—Chicago

(Chlorinator room; chemical loading platform; outside screen house; chlorine tank room—man at extreme right is Mike Davoust, Sr. San. Engr., one of the guides)

mill, mill inspections and test reports of chemical and physical properties are used.

Trial test runs of pipe are required to be sure that the plant production will meet the specifications. Welding rods are checked for quality and all welds should be visually inspected. From time to time, as required by the specifications, specimens should be cut from the pipe and tested. Physical characteristics should carefully be checked against the approved shop drawings.

Coatings: Before the application of coating, all pipe should be thoroughly cleaned. Samples of the coating material should be analyzed to assure meeting requirements of the specifications. It is important that the priming material be allowed an adequate time to set before the application of a hot coating. In New York City, it is required that hot application of coating materials must be made not sooner than 4 hours or later than 96 hours after priming. Subsequent damage to pipe coating can be minimized by exercising proper precaution in transporting, stringing and installing the pipe. Suitable skids, blocks, and braces should be used where required. Internal bracing should be used on thin-walled pipe to prevent distortion. Wide slings are usually necessary to prevent damage to the coating while the pipe is being handled.

To avoid damage to pipe strung alongside a trench, the City specifies that no pipe shall be left on a City street for more than 6 hours prior to laying.

Machine excavation is permitted to a point 6 in. above finished grade and the remainder of the excavation must be compieted by hand. No rock is allowed to project nearer than 6 in. to the bottom or 12 in. to the side of the pipe. Clean earth is added to the bottom of the trench and thoroughly compacted to the underside of the pipe. All cinders are removed and replaced with suitable back fill.

Before acceptance of the finished job, three steps are taken: 1. Hydrostatic test for leaks. 2. Examination and electric testing of interior coating. 3. Disinfection of the main.

F. M. Randlett, Robert Hunt Co., Chicago, discussed the paper and stressed the fact that specifications are written for the express purpose of being used and that the end users should exercise proper care in the selection of competent inspectors to interpret specifications.

The task of the suppliers, inspectors, and the end users would be simplified if all specifications were explicit regarding all major provisions.

Russell C. Beam, Mgr., Welded Pipe Div., Armco Metal Products, Inc., Middleton, Ohio, also discussed the paper by Mr. Clark, and pointed out that shop inspection of steel pipe is usually provided by one of two ways: 1. Normal plant inspection provided by the supplier, or 2. Outside inspection either by the user's inspector or by an inspector from an outside inspection service.

Since machinery and humans are not perfect, inspection insures that the material meets the specifications. Inspectors fall, according to the mills, into three classes: Competent, incompetent and inexperienced and in need of instruction.

Needless to say, the latter two groups interfere with and cause additional expense to the mills. Outside inspection can be improved when proper personnel is selected as inspectors and when specifications are improved.

Pumping Equipment

A HISTORY OF THE DEVELOPMENT OF WATER WORKS PUMPING EQUIPMENT by G. M. Hinkamp, Gen. Mach. Div., Allis-Chalmers Co., Milwaukee, Wis.

Mr. Hinkamp traced the history of water works pumping equipment from the London Bridge water works pump which was installed in 1581 up to modern pumping equipment. His discussion was illustrated by slides showing major phases of the development of pumping units. The first water pumping unit in the United States was installed at Bethlehem, Pennsylvania, in 1761. The first steam pumping unit was installed in New York. Early pumping units involved mostly steam and were of the low pressure type using three pounds or less.

Allis Chalmers in 1887 installed the first triple expansion unit at Milwaukee, Wis. It was the first high duty steam pump and its present day efficiency compares favorably to other means of pumping water. The intricacies of the mechanism along with present day high cost of labor has placed this type of equipment at competitive disadvantage with other types of prime movers.

Wisconsin Pollution Abatement Continues

According to an article in the bimonthly bulletin of the Wisconsin State Board of Health, stream pollution abatement in the State of Wisconsin has continued at a satisfactory pace. Work on this program really began in 1927, when the Committee on Water Pollution was established. The first step taken was to ascertain the degree of pollution of the major streams and ascertain ways and means of abatement of such pollution.

The primary objectives of the program were to remove solids responsible for odor and sludge deposits, and other offensive conditions; to prevent serious depletion of oxygen content of the streams; to remove toxic substances; and to destroy disease germs, bacteria and dangerous water supplies endangering recreational areas.

The policy was started in a drainage basin area, the first in 1931 on the Rock River. There are now 28 major drainage areas under consideration. Each study contained a program calling for planning, financing, constructing and operating of suitable sewage disposal systems.

Basin meetings, sponsored by the Board of Health, were helpful in inaugurating the work. During the 10-year period prior to World War II 103 new sewage treatment plants were built. Prior to 1943, a total of 228 plants were rebuilt or largely modernized. These plants serve 90 per cent of the population connected to sewers.

Following the war, installation of plants was resumed and at present there are 346 communities with sewage systems, 290 of which are served by 236 treatment plants, accommodating 90.7 per cent of the 1,900,000 population connected to sewers.

Of the 236 sewage treatment plants now operating, 112 are on complete treatment and 124 on primary treatment. Complete treatment plants serve 55.2 per cent of the sewered population and primary treatment plants serve 35.5 per cent.

Since 1946, 33 communities have installed or are constructing sewage treatment plants, and of these 12 have been started since the first of January, 1949.

Albright & Friel Move Offices

Albright and Friel, Inc., Consulting Engineers of Philadelphia, have announced the removal of their offices to Suite 1509-18, 121 S. Broad St., Philadelphia. President of the firm is Francis S. Friel, who last month was awarded an honorary Doctor of Engineering Degree by Drexel Institute.

FT. WORTH, TEX., MAKES QUICK COME-BACK FROM FLOOD DAMAGE

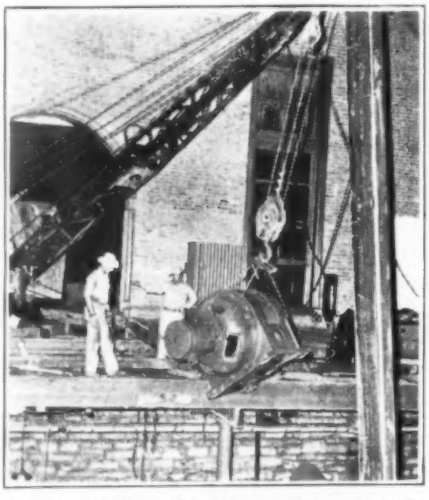
IN mid-May when the flood waters of the swollen Trinity River smashed four gaping holes in the levees and inundated large portions of the City of Fort Worth, it flooded the Holly Pumping Plant, cutting off the water supply for the entire city. The first floor of the pumping plant was submerged in two feet of water. The six main electric motors which drive the centrifugal water pumps, located in a pit 18 feet below the level of the first floor, were under 20 feet of water. With the exception of a few scattered artesian wells, the city was without pure water of any kind.

Drinking water was brought in by truck from the surrounding area. Hospitals cancelled all but major operations to conserve what little water was available. Emergency stations were set up to give typhoid fever inoculations. Fire was the greatest immediate danger, however, since without a controlled water supply to combat it, the smallest spark could transform the city into a raging holocaust. No effort was spared to get the pumps back into service as quickly as possible.

Power at the Holly Pumping Plant went off at 5:45 a.m. Tuesday morning, May 17. Until the water was pumped from the pit in which the main pump motors were located, nothing could be done to them. However, circuit breakers, switchgear, and vital instruments on the main floor also required cleaning and drying. Despite knee-deep water, this equipment was removed from the switchboard and by 4 p.m. that day was en route to the General Electric Service Shop in Dallas for overhaul.

The City of Fort Worth issued emergency pleas to all nearby communities for engine-driven pumps. These were put into operation pumping water out of the basement of the station immediately. At 8 a.m. the next morning the pit had been drained enough to allow removal of three of the six motors. These were shipped to Dallas also, where they could be cleaned and dried in an electrically-heated oven. Those motors which remained in the basement of the pumping plant were dried on the scene.

As soon as the water in the basement had gone down enough to permit work, mud and silt were flushed from the motors and asbestos sheds constructed over each of them. Three gas-fired space heaters, which normally heat the service shop during winter, were installed over the sheds. Temperature was thus raised to about 220-240 F. in order to dry out the winding insulation of the motors. This heating and drying process was continued for four days until megohmmeter readings showed that moisture content of the insulation had been reduced to a safe level. With a crew of six men working 24 hours a day, the earliest the motors could resume operation, however, was Monday of the following week.



Lowering 900 hp. Synchronous Motor into the Basement Pit at the Holly Pumping Plant, Ft. Worth, Tex.

But the city's need for water in case of fire was so urgent that additional steps had to be taken. An old reciprocating steam engine, built in 1892, was started up May 18 at 10 a.m. Rated at only 8 mgd., the engine was kept pumping at a rate of 15 mgd. until 3 p.m. when a burned-out bearing forced its shutdown. Workmen succeeded in replacing the bearing by 10 o'clock that night and the engine was put to work pumping again.

Meanwhile city officials requested the General Electric Co. to do everything possible to hasten completion of a new 900 hp. synchronous motor already on order. A check with the company's Fort Wayne, Indiana, Works at 11 o'clock Tuesday night revealed that the motor was not scheduled to be completed for days. A motor of similar rating, however, was available. By working three shifts, the motor underwent rush alterations and complete retesting in only 10 hours, several days usually being required, and was shipped by truck Wednesday. Arrangements were made for a police escort to meet the truck at the Oklahoma-Missouri State line and accompany it, in relays, all the way to the Fort Worth Holly Pumping Plant. Thirty-three hours and 1,009 miles from Indianapolis, the truck rolled into the pumping plant yard at 1:05 a.m. May 20.

Six and a half hours later the delicate job of aligning the two pieces of equipment had been completed and the unit was pumping 27 mgd.—well above its nameplate rating—into the water mains of the city. This 27 mil. gal. plus the 8 million being delivered by the reciprocating engine still fell short of the daily consumption which was above normal for the first few days after service was resumed. The emergency installation did, however, ease the situation somewhat and greatly diminished the hazard of fire

While the episode of the motor was going on, the meters and instruments which had been removed from the switchboard at the Holly station were cleaned in Dallas and flown on May 18 by Braniff International Airways to the G-E Denver, Colo., Service Shop where facilities were available for completely reworking and recalibrating the devices, in an all-night race against time.

According to Fred King, Supt. of Production for the Water Dept. of the City of Fort Worth, "The emergency repairs to all electric motors, switchgear, transformers, and other apparatus at the pumping station were completed in an unusually short time. The flood left equipment completely water-logged and the entire plant shut down. Thanks to the co-operation of all the men who worked on the rehabilitation of the plant, and to G.E. and its service shops at Dallas and Denver, we were able to resume pumping operations far in advance of first estimates."

R. R. Gish Joins Couch & Kulin Engineers

Couch & Kulin, Inc., Consulting Engineers of Indianapolis, Ind., have announced the association of Roy R. Gish as a member of the firm. Mr. Gish has had experience with the Chicago Sanitary Dinstrict, the Indiana State Highway Dept., the Indianapolis Water Co., and several Indianapolis architects.

IN SEATTLE ALL IS SERENE

Leastwise According to This Commentary to the Editor

from

WM. C. MORSE

Water Superintendent

SEATTLE, WASH.

IN MY attendance upon the American Water Works Conventions and gatherings, I go with the idea of gaining information of advantage to this department from the papers, conversations and discussions that are held—and always I have brought home some ideas of real value. However, it seems to me that the time of conventions is taken up primarily with the description of troubles that are had by the different operators.

A great category of troubles are described. And it is probably very fortunate that no *one* operator is burdened with all of them at the same time, but there are some that have enough troubles to make their lives really worth living. These troubles are very real and press heavily on those in responsible charge and they should be fully discussed—and are.

"Some of the Troubles I've Seen"

I listen to troubles over the source of supply, its volume, its purity (or, generally, lack of purity), its hardness and the difficulty of protecting any water except a well supply, which may frequently contain enough minerals and other objectionable features to make it at least most interesting to attempt to make it palatable.—Then I listen to the tale of water operators regarding "active waters" or where corrosion lends a blight to the happy dreams of the operator; or if it isn't corrosion the occasional operator speaks of the terrible taste and odor that can only be treated in a most incomplete and unsatisfactory manner, and still leave for the people to drink nothing much better than a chlorine cocktail. If it is a surface supply then the curse of algae in its many forms and also of the other forms of vegetable and animal life that are sure to aggravate the operator of almost every surface supply are a problem; then I hear of troubles of pumping, of distribution, and of this and of that until I wonder why it is that any man can be foolish enough to stay in such an exasperating and trying line of endeavor as this water works business.

Then I sit back and I am surprised to see how many of these troubles are totally absent from our operation and how few troubles we have that, comparatively, amount to anything at all.

The "Overpaid" Author

Our supply is drawn from the mountains, from a completely guarded watershed of sufficient size to supply a volume of water three times that which the City now uses. It is remarkably soft, with a hardness of but 22 parts per million, and with a clarity at nearly all times equal to that of crystal, and is brought in through two separate transmission mains to within thirteen miles of the City, where the primary reservoir containing 1,400,000,000 gal. of water is held in reserve. This reservoir can either be utilized as a source of supply or can be by-passed, and the river water brought directly into the city. This primary reservoir is at an elevation sufficient to allow gravity supply to flow into the city's intermediate reservoirs, eliminating all pumping, excepting a matter of 18% which goes to the higher levels, 80% of which is pumped by hydraulic turbines, through which the water flows from the intermediate service reservoirs to the low service reservoirs. We have no silting problem, our watershed area being so heavily carpeted with a coniferous forest that there is substantially no erosion, and no water is brought into our City carrying more than two parts per million turbidity. While this water is clear to the eye, there *is* a deposition in the pipe grid. And in case of a break in a main, a fire, or extra heavy sprinkling demand for a few hours, there may be a temporary discoloration in the water, occasioned by the added velocity scouring the mains. It amounts to nothing, and is so readily explained that it excites no adverse criticism. We have no filtration with all its manifold problems to vex us. Corrosion, while present in a minor degree, creates no problem. We do have some algae, but it is readily dealt with through the systematic use of copper sulphate. So I have come back from the 1949 convention wondering again why, in view of the poor pay which many of the water works operators throughout the country are given as a compensation for an endless strife against most difficult problems—why should the City of Seattle even consider paying its Water Superintendent anything at all—for if the trials and tribulations attendant to a job are a fair measure of what the compensation should be, then in comparison to many other operators I must consider that I owe a great deal to the City of Seattle—the city without troubles attendant upon its water character or supply.

Distribution is something else. Here our problems are identical with every other system—getting water to where it is wanted. Rapid population growth always results in growing pains which, generally, while they may be acute, are short lived. At the time, however, they do occasion many headaches for the operator. Perhaps a certain number of troubles are good for an operator; they make him realize that he is an operator—just as Mark Twain's dog needed a few fleas to make him realize that he was, after all, a DOG.

"Are You Out, Mr. E?"

". . . and he says never mind the name."

OXIDATION–REDUCTION POTENTIALS IN SEWAGE TREATMENT*

JOHN W. HOOD, Supt.
SEWAGE TREATMENT WKS.
RIDGEWOOD, N.J.

and

GERARD A. ROHLICH, Assoc. Prof.
LAB. OF HYD. AND SAN. ENGR.
UNIV. OF WISCONSIN

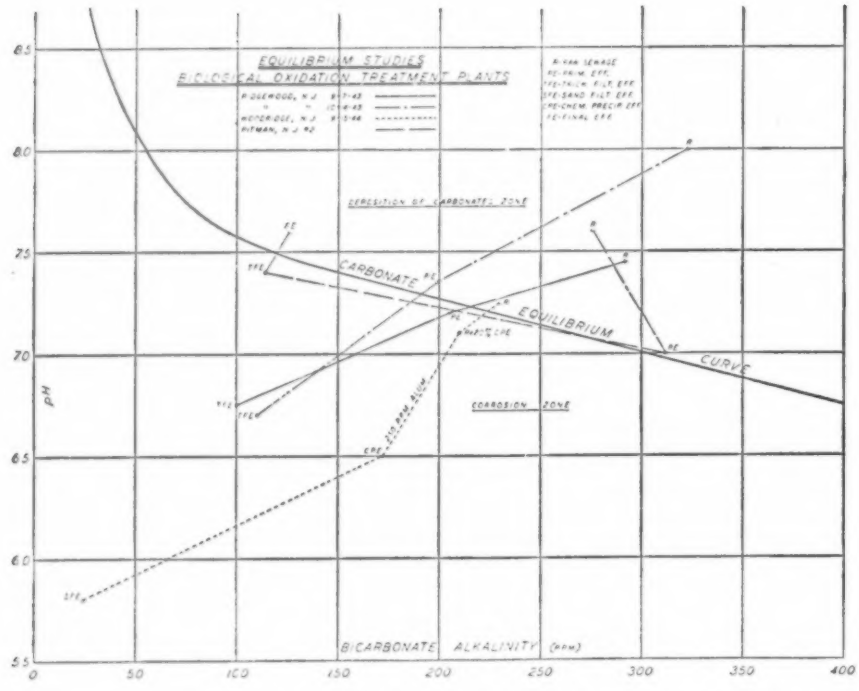


Fig. 1—Comparison of Equilibrium in Three Biological Sewage Treatment Plants

THE significance of oxidation-reduction potential as a vitally important factor of biological environment has long been appreciated by investigators in the fields of bacteriology, biochemistry and soil microbiology.

The measurement and study of oxidation-reduction potential, hereafter referred to as "O-R" potential, in and through sewage treatment plants, and their unit processes, is of much more recent date, and consequently the data are meagre. The first work of record, reporting on the measurement of "O-R" potential in the activated sludge plant at Madison, Wis., appeared in 1941[1]. In 1944 a further report was published[2], and in 1948 a third article appeared in print[3]. These constitute the record as related to sewage treatment plants, and the biological processes, both aerobic and anaerobic employed in such plants.

Basic material on the measurement and interpretation of oxidation-reduction potentials may be found in the references given in the papers mentioned above. These include reference to the work of Hewitt[4], Clark[5], Waksman[6] and Chang[7].

Definitions

O-R potential may be defined as the electrical pressure existing in a liquid as a result of the respective concentrations of oxidant and reductant present. This potential or electromotive force is measured by means of a vacuum tube potentiometer equipped with an appropriate electrode system, and is reported as E_h or emf. in millivolts of positive or negative sign or polarity. The term E_h denotes the potential as referred to the normal hydrogen electrode.

Attention is directed to the correction of potentiometer readings for half cell potentials. Arbitrarily standardized values for half cell potentials for the various electrode systems in use may be found in Table A, Appendix, in William Mansfield Clark's "The Determination of the Hydrogen Ion." The algebraic sum of the dial reading (potentiometer) and the appropriate half cell potential yields the O.R.P.—For example:

Half Cell KCl (sat.) Hg Cl/Hg C20°C Potential = +0.250 volts
When Dial reading = −0.432 volt (digester sample)
½ cell potential = +0.250 "
O.R.P. = −0.182 v or −182 millivolts

Or when Dial reading = +0.250 v (aerator sample)
½ cell potential = +0.250 v
O.R.P. = +0.500 v or +500 millivolts

The following factors must be considered in a determination of the oxidation-reduction potential of a system:

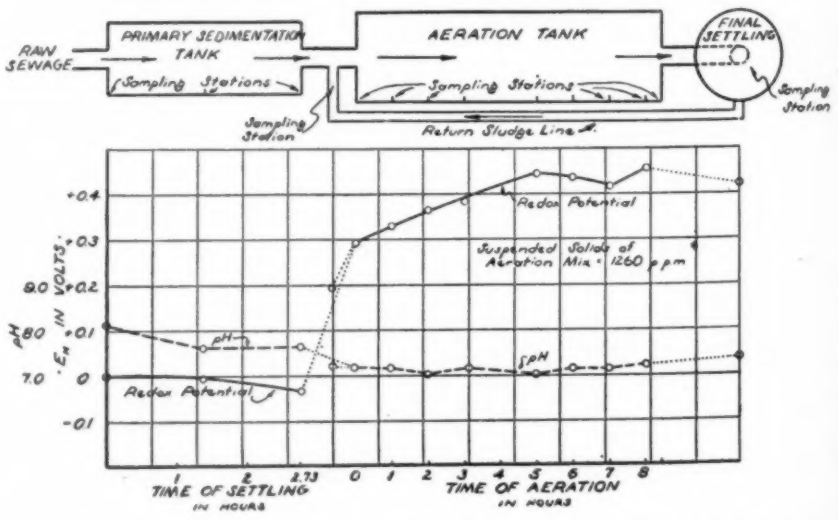


Fig. 2—Electrode Potential-time Survey and pH Survey Through Activated Sludge Plant at Madison, Wis.

*Condensed by the authors from their original article published in *Sew. Wks. Jour.*, Vol. 20, p. 640, July 1948.

1. The ratio of the concentration of the oxidant to that of the reductant.
2. The temperature of the solution.
3. The tendency of the system to take up or give off electrons.
4. The hydrogen-ion concentration.

Oxidation and reduction may not be so specifically defined, since there are several ways in which it may be stated, with equal veracity, that a subject has been oxidized or reduced. In a complex heterogeneous mixture such as sewage undergoing biological processing, where undoubtedly many oxidizing and reducing systems, both reversible and irreversible are concerned, it is unlikely that a simple, direct, theoretical explanation of the oxidation or reduction processes will be forthcoming.

Oxidation may be defined as a process in which (a) the proportion of oxygen or acid-forming elements or radicals is increased; (b) hydrogen is removed; or (c) a loss of electrons occurs with a resulting increase in positive valence; inversely, reduction would involve (a^1) a loss of oxygen; (b^1) a gain of hydrogen; or (c^1) a gain in electrons, reflected by a decrease of positive valence.

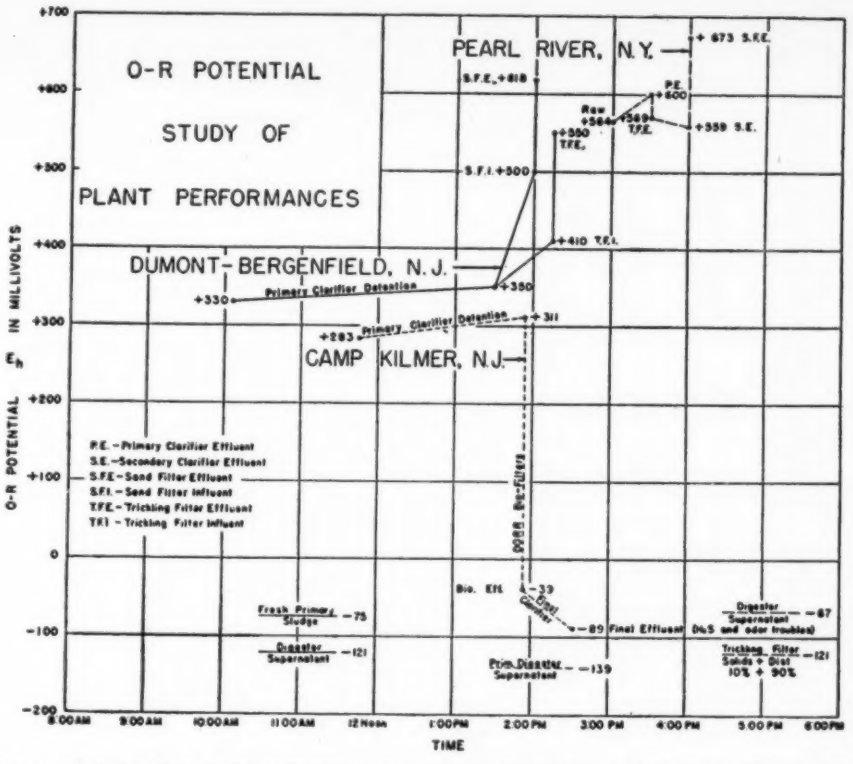


Fig. 4—O.R.P. Study of Plant Performance at Bergenfield-Dumont, N.J., Camp Kilmer, N.J. and Pearl River, N.Y.

Sampling

Sampling technic is all-important in O-R potential determination, and the actual measurement should be made as soon as possible after the sample is taken. One-liter beakers are preferable to smaller vessels. This in turn involves the use of long-pattern (15 to 18 cm.) electrodes. Samples are obtained wherever possible by inverting the beaker, cutting the liquid surface with the top edge, then gradually righting it in the liquid. Agitation of the samples may disqualify them from having any representative significance, especially in the case of poorly poised systems, such as raw sewages. To avoid misleading values, the sample should be taken directly from the contents of a tank or clarifier, and not from the effluent launder or flume. Where little or no displacement is occurring it may be necessary to sample at various levels due to stratification, as in the case of ponds or lakes.

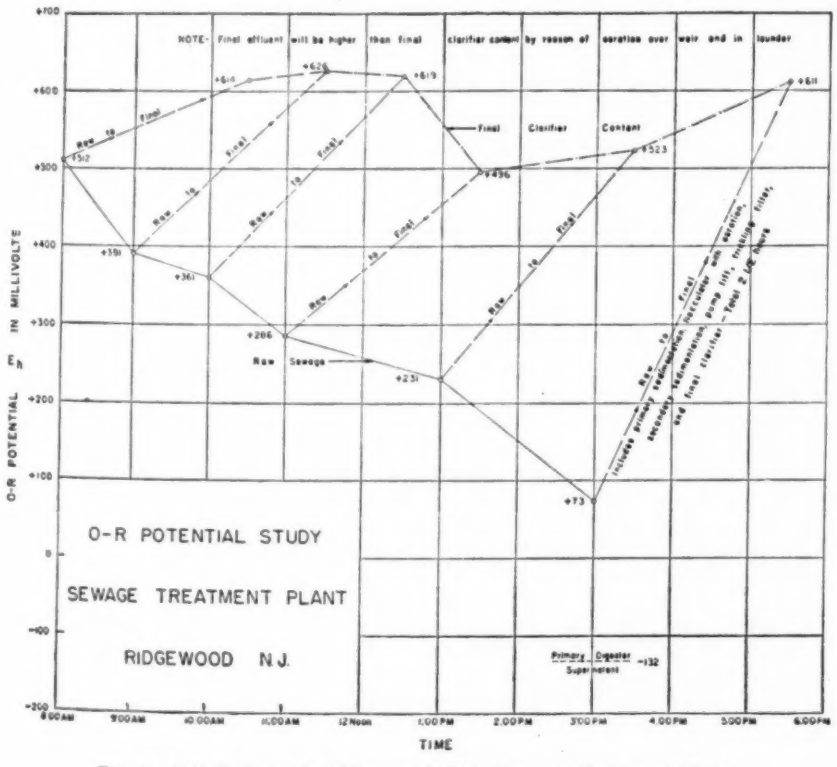


Fig. 3—O.R.P. Study in Ridgewood, N.J., Sewage Treatment Plant

Procedure

Throughout this work a Hellige potentiometer, equipped with a Hellige platinum electrode and calomel cell, was used.

With platinum electrode clean, liquid junction of reference electrode renewed, zero emf. of dial fixed opposite the index line, temperature compensator adjusted, selected switch on "A" or positive circuit if sample is from an oxidation process or on "B" or negative circuit if sample is from a reduction (digester) process, the electrodes are immersed in the liter beaker of sample and a time reading taken. Readings should be taken every minute on samples with which the operator has had no previous experience, and continued until equilibrium or a reverse trend is noted.

In practice, the time element is found to vary considerably at different

plants, and to range from 10 to 30 minutes. Assuming that 10 min. is required to reach equilibrium in the initial sample, then all subsequent samples from that process should be given the same time element. Only the final stabilized reading is taken, any and all intermediate figures serving only to show by their increments how dynamic or static the system is. For example, when a platinum electrode is placed in an acid solution of ferrous and ferric salts, glacial acetic, or concentrated sulfuric, a comparatively stable potential will almost immediately be attained.

On the other hand, in sewage treatment practice, poorly poised O-R potential systems are encountered which require an appreciable time element to reach equilibrium. Inability to balance the circuit by operation of the potentiometer rheostat and push-button switch may be an indication that the system under examination is of opposite sign to the selector switch position. This is easily remedied by switching over on the other circuit. It is a common experience to find negative values where there should be only positive values, due to conditions which will be discussed.

Graphic Examples

In sewage treatment processes, the effect of oxidation on buffer capacity as indicated by a reduction in pH and alkalinity is shown in Fig. 1. Figs. 2, 3, and 5 portray oxidation as defined in (c) above, and Fig. 4, oxidation and reduction as defined in (c) and (c') respectively. The relative oxidation and reduction intensity levels or potentials of activated sludge, stone and sand filters, and anaerobic decomposition tanks or digesters, are also shown in Figs. 3, 4, and 5.

Practical Aspects and Applications

Waksman[6] states that . . . "the oxidation-reduction character of bacteriological media exerts an important influence on the growth and behavior of organisms toward atmospheric oxygen. A knowledge of the oxidation-reduction potential of the media is important . . . . . in obtaining the optimum growth of an organism." Hence, we find that in a biological oxidation system such as the activated sludge process, a positive E_h must be maintained. A value in the magnitude of 200 to 600 millivolts usually reflects a favorable oxidizing intensity level, if the process is to be continuous and successful in spite of the wide variations in the volume and character of the influent. Many industrial wastes as well as domestic sewages possess a negative potential at the plant influent. This condition must be reversed in and through an oxidation device, and represents additional loading or work to be done, not necessarily revealed by standard methods of routine analyses.

Inability to handle shock loads of this type may result in a lowered oxidative intensity level, or decrease in the positive value of the O-R potential, and replacement of oxidizing organisms with facultative, and in extreme cases anaerobic organisms as indicated in Fig. 6.

In anaerobic systems, such as sewage sludge decomposition, unless the E_h is maintained at a negative value in the magnitude of —100 to —200 millivolts, the process will be retarded and the accumulation of undigested sludge, or scum, will occur.

Conclusion

O-R potential measurements will be found useful in detecting conditions in sewer systems and in plant units which may be conducive to anaerobiosis. The early detection of such conditions will permit the application of remedial measures of a preventive nature.

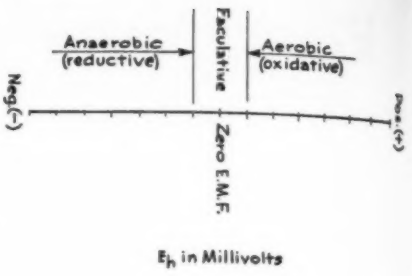


Fig. 6—Zones of Biological Classification

Following are some of the more obvious applications:

1. Detection of deposits, growths or other conditions in the sewer system or pumping stations leading to septicity or sulfide production; for observation of the effectiveness of sulfide control measures.
2. Detection of industrial wastes.
3. Detection of toxic substances or conditions.
4. Establishment of proper sludge pumping schedules at primary sedimentation tanks, through the detection of excessive sludge accumulations.
5. Detection of over-long detention periods at primary tanks.
6. Determination of internal conditions within trickling and sand filters.
7. Determination of conditions in activated sludge aeration tanks.
8. Detection of excessive sludge blanket in activated sludge settling tanks.
9. Determination of conditions in sludge digestion tanks.

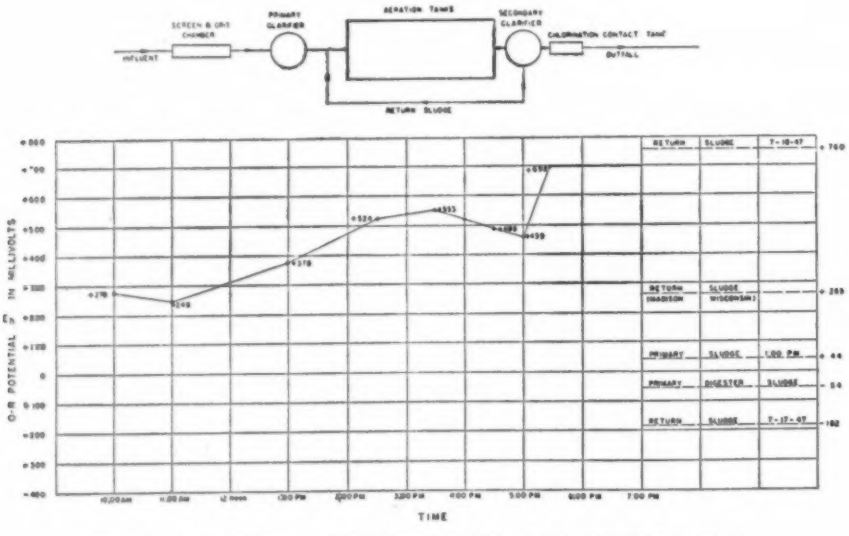


Fig. 5—O.R.P. Survey of Hackensack, N.J., Activated Sludge Plant

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PRECONDITIONING AND DIGESTION OF SEWAGE SLUDGE

The Fourth of a Series of Articles from the Operator's Viewpoint

Temperature Control, Feeding, Stirring, Recirculation and Bacterial Diet

by

T. R. HASELTINE

THE CHESTER ENGINEERS
PITTSBURGH, PENNA.

TEMPERATURE plays an important part in the activity of all plant and animal life. Even we humans are less productive if the temperature is too high or too low. Since sludge digestion is a biological process, it is not surprising that temperature control is of extreme importance. Different strains of bacteria may have different optimum temperatures. My own personal observations seem to indicate that those responsible for the digestion of proteins and fats may require somewhat higher temperatures than those responsible for the digestion of carbohydrates, although I know of no laboratory tests to confirm, or disprove, that idea.

At any event, laboratory tests have shown that there is one group of organisms that function below temperatures of 108°F. and another group that function above that temperature. Digestion at the lower temperatures is called "mesophilic digestion", as contrasted with "thermophilic digestion" at the higher temperatures. Since thermophilic digestion is not widely used, we will not consider it here.

Mesophilic digestion practically ceases at temperatures below 40°F., reaches a peak at 95° to 100°F., and drops off at temperatures above 108°F. At 80° digestion progresses twice as fast as it does at 60°, and three times as fast as it does at 40°F. Increasing the temperature to 95°F. makes it possible to complete digestion in about two-thirds the time required for digestion at 80°F. All of these figures are based upon times required to complete 90 per cent of the gas production (about 25 days at 95°F.); longer time may be required to obtain a clear supernatant and maximum alkalinity development. It is not practical to utilize temperature control in Imhoff or septic tanks.

The Author

TEMPERATURE CONTROL

To reap the full benefit of temperature control it is necessary to maintain as nearly a uniform temperature as possible from top to bottom of the digester. The temperature should not be subject to rapid changes either up or down. If raw sludge is materially different in temperature from the digester contents, it is better to introduce small amounts several times a day instead of a large amount only once a day. Even if a digester is materially below the optimum temperature, it is better to raise its temperature slowly over a week or two instead of doing it rapidly.

Internal Heating Coils

The most common method of heating separate digestion tanks is by circulating hot water through coils immersed in the tank. The coils may be placed horizontally and supported from the tank walls as in the case of movable cover tanks, i.e. floating covers and gas holders, or they may be placed vertically and be supported from the bottom and the fixed cover. The vertical coil banks are usually arranged so that they may be removed for inspection, cleaning and repair. This is a real advantage because the horizontal coils are quite inaccessible.

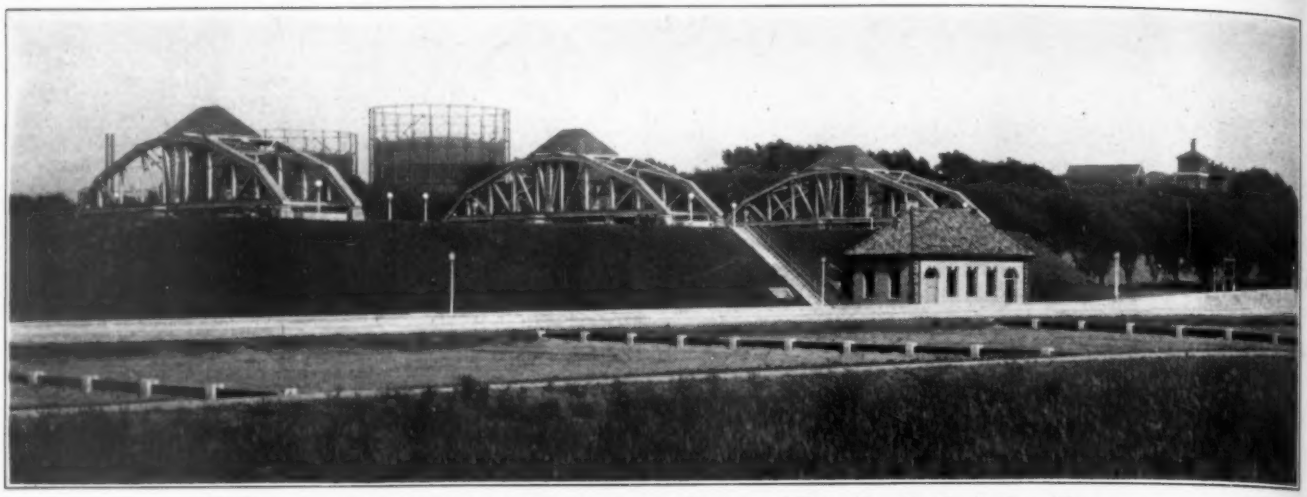
The frequency with which the coils must be cleaned depends upon the temperature of the coils. The hotter they are the quicker the sludge will build up a semi-dry insulating crust on them and so reduce their effectiveness. To avoid unduly rapid deposition of sludge the water entering the coils must have a temperature below 140°F., and temperatures of 110° to 120°F. are more desirable.

The amount of heat that can be transferred from the coils to the sludge depends upon a number of factors, among which are the amount of water circulated through the coils and the difference in temperature between the coils and the sludge. Heat transfer can be calculated if the volume of water and its temperatures entering and leaving the coils are known. Therefore, the operator should keep a daily record of these data. If circulation is continuous (as it should be) recording thermometers are not necessary. Ordinary indicating thermometers will suffice if they are read at the same time each day. (They should be checked against a good laboratory thermometer every month or so as they sometimes "go haywire." If such records are conscientiously kept and *reviewed once in a while*, it is a simple matter to determine whether or not the coils are becoming coated with sludge.

Other Methods of Sludge Heating

Various other methods of heating digesters have been given more or less consideration in recent years in an effort to overcome the necessity of cleaning coils. They include the following:

1. Introduction of hot water directly into the digester.
2. Use of submerged gas burners either in the digester proper, or in a separate tank outside the digester through which raw sludge and/or the tank contents may be pumped.
3. The so-called "radiant heat" or warm wall method in which the coils are imbedded in the concrete walls of the tank.
4. Injection of live steam directly into the raw sludge before it enters the digester.



Erie, Penna.—Sludge Drying Beds, Digester Control House, and Three Dorr Co. Single Stage Digesters

5. Use of outside heat exchangers in which hot water is circulated around the outside of pipe coils through which raw sludge and either digesting sludge or supernatant liquor from the digester are circulated at such high rates that sludge caking is minimized.

The first two methods have only been used experimentally, but the other three are in use in a few actual plants. It is my opinion that the fifth method is the most suitable for general application and my firm is now applying it in most of our recent designs. We did recommend the injection of live steam in one particular case. I have no first hand operating data on any of the new methods and since they are not yet in common use, I will not attempt to discuss their operation.

Heat Requirements

The heat required to maintain any given temperature in the digestion tank is made up of (a) the heat that would be required if no inflow or withdrawals were made, and (b) the heat required to raise the temperature of the raw sludge input to the temperature of the tank contents. The first requirement is a function of the temperature difference inside and outside the digestion tank, and the size, shape, and type of construction used for the tank. Since the operator should attempt to hold the inside temperature close to 95° it is obvious that he has no control over this heat requirement. The warmer the weather and the better the insulation of the tank the less it will be.

The heat required to bring up the temperature of the raw sludge is usually by far the greater. The operator can minimize this materially by reducing the moisture content, and hence the volume, of the raw sludge by one of the methods previously discussed under sludge conditioning. I have seen cases where the total, overall, heat requirements were reduced at least 50 per cent by careful sludge conditioning. Where two-stage digestion is used, it is frequently unnecessary to heat the second stage and this may be one reason for its adoption. (We will discuss stage digestion later.)

The heat requirements are usually satisfied by utilizing the sludge digestion gas either directly in boilers or by using it to drive engines and recovering the heat otherwise lost in the engine cooling water and exhaust gases. (The subject of gas production will be discussed later but gas handling and utilization will not be discussed in this series.)

SEEDING, STIRRING AND RECIRCULATION

As previously stated, the raw sludge contains a heterogeneous mixture of different kinds of micro-organisms, some of which assist digestion, some retarding it, and some dying out and having no effect at all. On the other hand, if the digestion process is functioning as it should, the bacteria predominating in the digesting sludge will be those particular forms most helpful in producing digestion. Just common sense tells us that it is a good idea to inoculate the raw sludge with these desirable organisms as soon as possible. This "seeding" can best be done by thoroughly mixing the raw and digesting sludges together. Sometimes supernatant is used for seed instead of digested sludge. Either one is satisfactory. However, if sludge is used, it should be actively digesting, not old thoroughly digested material that has stood dormant for several months.

Mixing

The mixing can be done either inside the digestion tank, or outside before the raw sludge enters the digester. If the relatively new outside heat exchangers are used for heating the digester, the raw sludge becomes mixed with supernatant liquor as it flows through the exchanger. If a decanting tank is used for concentrating the sludge, it is usually feasible to draw digesting sludge to that tank and then pump the mixture back to the digester. Although it is desirable to be able to use outside mixing at times, it usually isn't necessary as a routine procedure.

If the sludge in the digester is actively digesting, the natural ebullition of gas frequently causes all the mixing or circulation necessary.

Recirculation

Some times cold raw sludge tends to settle to the bottom of a warm, fairly quiescent digester. At other times raw sludge high in fats is buoyed up to the top by the gas and tends to stay there, forming a scum. Pockets of raw sludge at the bottom must, of course, be pumped out and re-introduced at some other point, i.e. the sludge must be recirculated. Scum accumulations can frequently be broken up by pumping warm supernatant liquor on to them at the gas collection dome (if piping is arranged so such recirculation is possible).

Various types of stirring or mixing equipment are some times used in digestion tanks to facilitate mixing. The oldest type, made by the Dorr Co. and others, resembles a circular clarifier mechanism in that it has sludge rakes that tend to move the bottom sludge to a central drawoff point. It also has so-called scum breaker arms near the top of the tank. Sometimes it is necessary to reduce the sludge input

Buffalo, N.Y.—Four 90-ft. P.F.T. Floating Cover Digesters with Control House in Center

to a tank so equipped in order to avoid overloading the stirring mechanism when otherwise the tank could handle the additional raw sludge fairly satisfactorily. I consider this a disadvantage to such mechanisms and do not believe their use is warranted. Many authorities, however, disagree with me.

Another type of mixing equipment consists of two or more turbine mixers on a vertical shaft. Large tanks may have as many as three or four of these mixing devices in them. Again there is a difference of opinion concerning the merits of the equipment; some believe that the added operating and maintenance costs are not justified. Usually this type of equipment is used in conjunction with banks of vertical heating coils. The agitation caused by the turbines at least speeds up sludge movement around the coils and thus facilitates heat transfer.

A third type of equipment consists of vertical pumps suspended from the digester cover that cause vertical circulation by pumping either supernatant (Buswell patent), or bottom sludge (Pruss patent), to the top of the digester. This equipment may be very effective in combating scum formation but may interfere with concentration of digested sludge at the bottom of the tank.

I believe that it is the duty of an operator to attempt to operate whatever type of mixing equipment he may have in the manner it was intended to be used. One need not be too concerned about the claims and counterclaims made for other types of equipment. That is the designer's problem.

BACTERIAL "DIET"

So far we have pointed out that sludge digestion is the result of the life process of certain strains of microorganisms. Since these "bugs" perform such a useful function, we try to make them as happy and healthy as possible. We carefully control the temperatures and the acidity, or alkalinity, of the digester so as to make "climatic" conditions as ideal as possible. We limit the amount of undigestible mineral matter in the raw sludge and then bring that sludge into intimate contact with the "bugs" (seeding) so that they won't have to hunt for a food supply. It only remains to make certain that the "food" served them is a well-balanced healthful diet free from poisons. Now it seems that just as humans eat and enjoy carbohydrates and fats but cannot be healthy without proteins as well, so at least some of these "bugs" must have nitrogen in their diet.

Nitrogen Requirements

Buswell[13] shows that some bacteria responsible for gasification of carbohydrates seemingly utilize ammonia in building up their own structures, converting the nitrogen into an organic form. Upon death of these organisms this organic nitrogen is digested by other bugs and reconverted to ammonia as previously explained. If there was no loss of ammonia in digested sludge and supernatant withdrawals, then the initial charge of nitrogen might be used over and over again. Normal sewage sludge from domestic sewage probably contains sufficient nitrogenous material so that, as a rule, the operator need not worry about supplying the bugs with ammonia. However, Buswell[13] has shown that the addition of ammonia in the form of ammonium carbonate, ammonium chloride, or ammonium hydroxide greatly speeds up the digestion of carbohydrates, fatty acids and related compounds when the raw sludge is unusually high in such materials, i.e. sludges from brewery, distillery, or vegetable canneries.

Schlenz[12] shows how the addition of ammonium sulfate aided in the digestion of heavy scums of fatty material in military and municipal sewage plants. He[14] states as follows:

"Ammonium sulfate has been used as one source of ammonia nitrogen, the commercial product yielding about 25.6 per cent of ammonia nitrogen. The ammonium salt is readily soluble in an equal weight of water, and is easily obtained at low cost.

"It is added in relatively small doses of 50 to 100 lb. with continuous liquor recirculation between doses. Additions are made until about 30 ppm. of equivalent ammonia nitrogen has been added to the volume of the tank being recirculated, normally assumed to represent one-half of the tank contents."

While the laboratory technic for determining ammonia nitrogen in sludge is known, there hasn't been enough operating data collected to know what the optimum ammonia nitrogen content, as measured by that test, should be. Apparently it is somewhere between 700 and 1,400 ppm.

If this is the case, it seems strange that the addition of only 30 ppm. would make any material difference, but, apparently, it does.

Alkalinity

It was previously shown that much of the increase in alkalinity of the sludge as its digestion progressed was due to the formation of ammonium bicarbonate. Therefore, it appears logical to believe that if the sludge has an alkalinity above 2,000 ppm., and that alkalinity was the result of natural digestion rather than due to the addition of calcium magnesium or sodium compounds, then the sludge contains sufficient ammonia, and further additions would be of little benefit. I do not know this to actually be the case; however, Riddick[16] shows how the application of gaseous ammonia corrected an acid condition in the digesters at North Tarrytown, N.Y.

Balanced Diet

Although these "bugs" require a balanced diet, it seems that they do not like a diversified one. For example, if they are used to feeding on primary sludge alone, they may refuse a mixture of primary and secondary sludge until they get pretty hungry, or at least so it seems.

We noticed a marked drop in gas production at Topeka[4] when activated sludge was first wasted. As I recall, gas production fell off fully 20 percent; however, after a week or ten days gas production came back to as much, or more, than it had been.

At Butler, Pa., the trickling filters pond and partially clog each winter and then unload each spring. The unloading results in a sudden increase of secondary sludge solids delivered to the digester. We usually, however, encounter a drop in gas production during the first week of unloading, followed, of course, by increased activity. Maximum gas production usually occurs shortly after filter unloading has dropped to normal. The moral of this is that the operator of a complete treatment plant should deliver excess and activated sludge, or trickling filter sludge, solids to the digester daily instead of letting them accumulate and making deliveries only two or three times a week.

Toxic Wastes

Since digestion is a biological process, it is obvious that toxic, or germicidal, chemicals might interfere with it. However, there seems to be considerable difference between the action of some of these toxic compounds on the liquid sewage, and their action on the sludge. We are all familiar with the germicidal properties of chlorine, but prechlorination of sewage certainly has no deleterious affect on sludge digestion. (It has even been claimed that prechlorination assisted in controlling foaming of some Imhoff tanks, although it is not a sure solution to that problem.) The reason chlorine has so little effect on digestion is probably twofold; first, the chlorine probably never completely penetrates the solids and, second, sufficient chlorine is never used to produce an actual residual in the raw sludge pumped to the digester, i.e. free chlorine probably never reaches the organisms in the digester that are responsible for digestion.

Many compounds containing metals such as copper, nickel, mercury, etc., are known to be toxic. In several cases it has been found that such compounds in the raw sewage are more injurious to sludge digestion than they are to even the temperamental activated sludge process. It seems that even though these metallic compounds may originate as sulfates or some other salt, they are hydrolyzed after becoming mixed with the sewage, so that they are precipitated as hydroxides and, for the most part, are transferred to the digesters. There they gradually accumulate until they build up to toxic quantities.

At Kenosha,[18] Wisconsin, it was found that although the incoming sewage averaged only 0.7 ppm. copper, the metal was precipitated in the sedimentation basins and the raw sludge removed from them averaged 226 ppm. on a wet basis, or 3,710 ppm. on a dry solids basis. Further concentration of copper, on the dry solids basis, occurs in the digester due to digestion of some of the solids. At Kenosha they believe that, insofar as sludge digestion is concerned, the dry solids basis is the most logical one for reporting metal concentrations. Their experience indicates that on that basis, 2,500 ppm. causes no interference with gas production; 5,000 ppm. reduces it 25 percent, and 9,000 ppm. reduces it 50 percent.

Wischmeyer and Chapman[17] show that nickel concentrations in excess of 500 to 1,000 ppm. (on a wet basis in the sludge) definitely retarded digestion, but that lesser amounts apparently stimulated gas production.

Riddick[16] shows how alkaline zinc and mercury wastes disrupted digestion at North Tarrytown, N.Y., but gives no data on the metallic concentrations in the sludge. Meadville, Pa.[19] had considerable trouble with these metallic wastes several years ago. Digestion was completely stopped. The raw sludge contained 2 percent copper and 9.6 percent chromium on a total dry solids basis. The corresponding figures for the digester contents were about 2.6 percent and 9.7 percent respectively.

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(16) T. M. Riddick, "Dead Digesters." *The American City*, vol. 43, p. 90 (May 1948).

(17) W. J. Wischmeyer and J. T. Chapman, "A Study of the Effect of Nickel on Sludge Digestion." *Sewage Works Journal*, vol. 19, p. 791 (Sept. 1947).

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*These references are a continuation of the list given in part III, and apply to this part of the series.

CINCINNATI PROVIDES FUNDS FOR SEWAGE TREATMENT

According to Edward J. Cleary, Exec. Dir. and Ch. Engr., Ohio River Valley Water Sanitation Commission, the city of Cincinnati has suited action to words since the signing of the 8-state anti-pollution compact a year ago. Cincinnati has now provided funds for the expediting of design of sewage-treatment works which will soon reach the construction stage. The ultimate cost of the program will be about $25,000,000.

More than $1,500,000 of the money that is required has been collected towards this end by means of a surcharge on water service. Nineteen cities and villages in the area, as well as the County of Hamilton, have entered into agreement to join with the city in the construction and operation of treatment facilities.

The major disposal works will be located on the Little Miami River and Mill Creek, the sites for which have been purchased.

In accordance with water-quality standards established by the Commission for the stretch of the Ohio River between Dams 36 and 37, the city of Cincinnati is revamping the design of its sewage disposal facilities to produce a higher degree of treatment.

ALABAMA WATER & SEWAGE ASSN.

4th Annual Meeting and Short School

WITH the cooperation of the Alabama Department of Public Health, the Alabama Polytechnic Institute, and the University of Alabama, the Alabama Water and Sewage Assn. held its 4th Annual Meeting and Short School at University, Alabama.

A record registration of 126 persons attended the Short School. The membership of the organization has grown to more than 100, about one-third of whom are now affiliated with the Federation of Sewage Works Assns.

Vice President
John Stalcup, Chief Chemist
Water Works
Mobile, Ala.

Secretary
Alex O. Taylor, Director
Engineering Extension
Auburn Polytechnic Institute
Auburn, Ala.

Treasurer
Gilbert H. Dunstan, Prof.
Sanitary Engineering
University of Alabama
University, Ala.

Tom Collins
Supt.
Water Dept.
Ozark
(President)

Geo. Godwin
Supt.
Water Dept.
Decatur
(Vice Pres.)

G. H. Dunstan
Prof. San. Engr.
Univ. of Ala.
University
(Host)

Alex O. Taylor
Dir. Ext. Serv.
Aub. Poly. Inst.
Auburn
(M. C.)

R. C. Barton
San. Engr.
Jeff Co.
Birmingham
(Fed. Direct.)

C. H. White
San. Engr.
Ala. Bd. H'lth
Montgomery
(Prog. Chair.)

V. M. Ehlers
Dir. San. Engr.
Tex. Dept. H'lth
Austin
(Fed. Pres.)

Present to represent the Federation was V. M. EHLERS, Chief Sanitary Engineer of the Texas State Department of Health and President of the FSWA. Mr. Ehlers spoke on voluntary certification and the work of the U. S.-Mexican Health Association, the Inter-American Association of Sanitary Enginers and the Federation.

As Chairman of the Committee on Research Projects under the National Institute of Health, Mr. Ehlers asked for representatives of the State of Alabama's two universities to file applications for research projects. He also explained a number of research projects which are now in operation. Mr. Ehlers believes that the whole Southwest should standardize on qualification of operators. The voluntary licensing and qualification of operators in Texas has proved a considerable boon in stabilizing the profession, reducing turnover and increasing salaries.

New Officers

President
George H. Godwin, Mgr.,
Water Dept.,
Decatur, Ala.

Editor, Official Bulletin
Chas. H. White, Asst. San. Engr.
State Dept. of Health
Montgomery, Ala.

Director of Fed. S.W.A.
R. C. Barton, San. Engr.
Jefferson County Engr. Dept.
Birmingham, Ala.

Technical Sessions

Following the address of welcome by Dr. John M. Gallalee, President, University of Alabama, ARTHUR M. BECK, Chief Engineer of the State Department of Health at Mobile, Ala., spoke on the responsibilities of water and sewage works operators. Mr. Beck reviewed the history of sanitation and pointed out the growth in the last two decades of sanitary engineering and the decrease in death rate from typhoid and other diseases with the advent of water purification and other modern practices. Mr. Beck stated that he believes the operators have done a great deal to realize their responsibility, which is that their actions, work and operations do not merely affect one person, but may affect the entire life of a community. For this reason, operators must be ever on the alert to possible troubles in both water and sewage treatment work.

Basic Chemical Principles

Dr. John E. Gran, Professor of Chemistry at the University of Alabama, presented two lectures on **Basic Chemical Principles.** In the first lecture, he discussed the Periodic Table of Chemical Elements, with particular reference to those elements which are of interest to water and sewage chemists—such chemicals as sodium, potassium (the alkali minerals), and the alkaline earth group, which contains calcium and magnesium.

In the second lecture, Dr. Gran spoke about carbon and silicon and the halogens. Silicon, of course, is of interest not only as a silicate in boiler waters, but as an aid to coagulation, activated silica being one of the more recent adjuncts to coagulation. In regard to the halogens Dr. Gran spoke of fluorine, chlorine, bromine and iodine, told of their production and of their action as disinfectants. Other elements of interest in water and sewage works are sulphur, oxygen, nitrogen and phosphorus.

Meter Maintenance

E. M. Stickney, Manager, Water Works, Mobile, Ala., spoke on the subject of **Water Meter Maintenance.** While disc meters are generally set to have an accuracy of 98 to 102 per cent, Mr. Stickney doubts the extreme accuracy at low flows because the clearance is too small in disc meters. The sensitivity of these meters is affected by the character of the water, the presence of suspended matter, and general wear and tear on the mechanism.

In Mobile it was found that out of 16,000 meters, 6,000 were inopera-

tive; and Mr. Stickney said that inasmuch as "meter maintenance is revenue maintenance," his department established a meter shop and began checking and repairing these inoperative meters.

On the theory that the close clearance required to maintain 98 per cent accuracy makes the meter liable to becoming stuck with sand or other suspended matter particles, Mr. Stickney said that at Mobile the limit of accuracy was set at 95 to 102 per cent at 3 gpm. flow. As a result of this program of repairing meters, the pumpage of the water plant was decreased 1.3 mgd., while the billing went up $852,000 in a year.

In discussing this topic, C. D. LAMON, Mgr. of the Water Works at Prichard, Ala., spoke on the problems of broken dials, warped discs and the effect of hot water. He also discussed the problem of when to use a compound meter, stating that if the demand was highly variable, such a meter was quite proper. In short, the type of meter to be used should be fitted to the type of service.

CHARLES D. HART of the Water Dept., Bessemer, Ala., said that he believed that if the meter is set at 95 to 97 per cent accuracy, better service is obtained. While this gives the customer slightly more water than he pays for, it also insures that the meter is less likely to become stuck. Mr. Hart also warned that in setting meters they should be kept out of the sun, and that the cutoff should be washed out before the meter was set. He also suggested backwashing meters to eliminate the possibility of dirt clogging them immediately after their first setting.

V. M. EHLERS, Chief Engineer of the Texas State Department of Public Health, Austin, Texas, spoke about the 2-day meter repair schools which have been held in Texas for the last several years. Eighteen such schools have been held in various parts of the state and it is conservatively estimated that these schools have been worth a million dollars a year to Texas water utilities.

Basic Electricity

John L. Snow, District Engineer, Layne Central Co., Montgomery, Ala., spoke on the subject, **Basic Plant Electricity and Equipment.** Mr. Snow compared electrical voltage, resistance and current to pressure, friction and flow in water. In both water and electricity, it is the difference in pressure which causes a movement of either water or electricity. In short, it is the difference in pressure in the case of water and the difference in voltage in the case of electricity.

Mr. Snow explained the generation of electricity, and its conversion from DC to AC; the advantages of AC current for transformation from low to high, or high to low voltage; as well as many other factors of electricity.

Among the other topics in reference to electrical equipment, Mr. Snow spoke about safety, giving the following six suggestions: (1) the entrance line should be either high above ground or underground; (2) all wiring should be in rigid conduits; (3) the whole system should be bonded for grounding and the ground connection should be tight; (4) proper rating of wire and insulation should be used for the type of installation made; (5) No. 4 copper wire is a good ground wire size; (6) on main feeder lines use a circuit breaker or fused switch and, in either case, it should be made big enough to handle a direct short.

Mr. Snow closed his talk with a discussion of station type lightning arrestors, and stated that it was impossible to protect against a direct stroke of lightning.

Safety

Gilbert H. Dunstan, Prof. of Sanitary Engineering, University of Alabama, spoke on the topic, **Safety in Water and Sewage Works.** Professor Dunstan emphasized the fact that too often we don't think about safety. There are three factors that must be considered in reference to safety in water and sewage works, and these are the man himself, proper equipment, and proper maintenance.

In regard to the first of these factors, if an individual makes a mistake the best safety devices in the world are no good. Proper attitude of an individual is necessary to maintain safe conditions. When men are careless, they are not fully alert.

Among the other comments in regard to individuals, Professor Dunstan said that, "The right way is the safe way," and that dangerous conditions should never be neglected, nor should individuals be allowed to throw away a safety device, when such is attached to a piece of equipment.

In regard to equipment, Prof. Dunstan pointed out that old equipment may need more attention and better safeguards. New equipment generally has safety devices as an integral part of the machine.

While warning signs are good, too many often lead individuals to ignore all signs. Among the things which should be given consideration as regards safety are switchboards, maps, lighting, stairs, and color coding of pipes; also the handling of dangerous chemicals.

Prof. Dunstan closed his talk with the statement that good housekeeping is essential to safety; that soap and water is the best way to prevent skin infections; and that all sewage plant operators should have in their files the Manual of Practice No. 1 on Occupational Hazards, published by the Federation of Sewage Works Associations.

Stream Pollution Control

John C. Clarke, Dir. Alabama Water Improvement Advisory Commission, Montgomery, Ala., reviewed the **Progress on Stream Sanitation Study** in the State of Alabama. The

Programmers All

A. N. Beck	*E. M. Stickney*	*J. C. Clarke*	*Dr. J. E. Gran*	*F. R. Strange*	*John L. Snow*	*Clay H. Dean*
Ch. Engr.	*Supt.*	*Director*	*Prof. Chem.*	*Mgr.*	*Dist. Engr.*	*San. Engr.*
Ala. Dept. H'lth	*Water Dept.*	*Str. Poll. Cont.*	*Univ. of Ala.*	*Water Dept.*	*Layne Central*	*Ala. Dept. H'lth*
Montgomery	*Mobile*	*Montgomery*	*University, Ala.*	*Ft. Payne*	*Montgomery*	*Montgomery*

work of this department has been carried on by one trailer laboratory and one field laboratory, staffed by an engineer, chemist and two samplers in each. The first samples were collected May, 1948, and the work is expected to be completed by the end of August, 1949.

The technics used followed the plan of the Ohio River Survey with one point of sampling being established above the point of pollution and two points of sampling below pollution. Samples were also collected from clean streams, but no plankton studies were made. As at the time of this progress report, 743 sampling points had been established, with 6,701 samples collected and 45,579 tests run. On the completion of these studies a report will be made and, based on this report, recommendations to the Governor and the State Legislature will be made to amend the Stream Pollution Control Act in Alabama. The amendment, if passed, will give the Commission power over pollution, rights to establish standards for water, rights to issue permits for waste discharge, rules under which waste discharge can be made, and the right to issue orders to abate pollution and to enforce these orders by circuit court action.

Round Table Discussion

In addition to the above papers presented before the General Meeting, Round Table Discussions were held on Water Works Problems and on Sewage Treatment Operations. Participating in the Water Works Round Table were W. U. Quinby, Manager, Water Works, Jasper, who led the discussion on Mains and Tanks, and F. R. Strange, Manager of Water Works, Ft. Payne, who led the discussion on Filter Media. The Swimming Pool discussion was led by Clay H. Dean, Asst. Sanitary Engineer, Bureau of Sanitation, Montgomery, Ala. Miss Ellen Howell, Director Tuscaloosa State Laboratory, gave a demonstration of technics of water bacteriological laboratory operation and E. E. Love, Chief Engineer, Water Works, Tuscaloosa, acted as instructor in chemical control tests for water works operation.

In the sewage treatment plant operation round table discussion, C. L. Gray, Operator, Ensley Plant, Jefferson County, acted as discussion leader on the topic of primary treatment. Cecil Nabors, Manager, Water and Sewage, Talladega, acted as discussion leader on secondary treatment. R. C. Barton, Sanitary Engineer, Jefferson County, Ala., led the discussion on sludge digestor and sludge drying beds. W. F. Chandler, Jr., Chemist-Operator, at the Shades Valley Plant, Jefferson County, Ala., acted as instructor in chemical control tests for sewage treatment plant operation.

There was also a demonstration of the taking down and assembling of gas chlorinators and solution feed hypochlorinators, conducted by M. E. Henley, Wallace & Tiernan Co., and Wm. V. Bishop of %Proportioneers%.

Entertainment

On one evening of the school motion pictures were shown, including Clean Waters, Laying of Cast Iron Pipe, and Health and the Cycle of Water and other pictures of interest to both water and sewage works operators.

The Annual Association Banquet was held at the McLester Hotel, with ALEX O. TAYLOR, Director of Extension Service, Alabama Polytechnic Institute, Auburn, Ala., acting as master of ceremonies. After dinner speaker was George E. Symons, Associate Editor, *Water and Sewage Works*, New York City, who presented one of his verbal columns, "Here and There with Doc Symons," including his "Reading Glasses" routine.

Some Programmers—Some Not

J. L. Crockett, Jr. *San. Engr.* *Ala. Dept. H'lth* *Montgomery*	*E. E. Love* *Ch. Engr.* *Water Dept.* *Tuscaloosa*	*W. B. Pebworth* *Hersey Mfg. Co.* *Atlanta,* *Ga.*	*W. U. Quinby* *Supt.* *Water Dept.* *Jasper*	*N. M. Berberich* *Engr.* *Water Co.* *Birmingham*	*C. J. Hammond* *Engr.* *Water Dept.* *Gadsden*	*A. F. Lankford* *Supt.* *Water Dept.* *Gadsden*

New England Interstate Water Pollution Control Comm. To Establish Permanent Office

An announcement has been made by the New England Interstate Water Pollution Control Commission that a permanent office and staff will be established within the near future.

Applications are being received for the position of Engineer-Secretary at an annual salary of $8,000.00. An applicant must be a professional engineer versed in water pollution control.

Applications should give age, education, experience, and references and should be addressed to Walter J. Shea, 335 State Office Building, Providence, Rhode Island.

Hydraulic Diagrams

The Contractors' Record and Municipal Engineering, Lennox House, Norfolk St., London, W.C. 2, has issued a booklet on *Hydraulic Diagrams*. This is known as "Hydraulic Diagrams No. 1—Flow in Circular Pipes and Culverts." This small bulletin opens up into a large sized page on heavy paper, on one side of which is a diagram of proportional velocities and flows in circular sewers flowing partly full. Also included is the Crimp & Bruges' Formula, from which this diagram was developed. On the other side of this 15 x 20 in. page is a diagram for flow in circular pipes and culverts. This diagram is presented for various diameters of pipes in inches and the velocity in feet per second.

The whole page folds neatly into a 5 x 7½ in. booklet, with cardboard back.

This useful diagram can be obtained by writing directly to *Contractors' Record and Municipal Engineering* in London. The price is 4 shillings for a single copy or 3 shillings 6 pence per copy for not less than six copies.

EXPLODED SEWER QUICKLY REPAIRED WITH CORRUGATED PIPE

by
THOMAS B. RAY
City Engineer
NEW ROCHELLE, N.Y.

SHORTLY after an extremely heavy rain storm one afternoon in July, 1948, a segmental tile storm sewer in New Rochelle, New York, literally "blew its top." The 84-inch sewer, which carried runoff from a greater part of the storm drains in the city, prior to that afternoon had seemed ample in size to handle the load.

Several factors contributed to its failure, however. In the first place, the structure had been backfilled to only approximately half its total height, so that there was no dead load over it to hold the top half in shape. This exposed portion was subjected to the vandalism of young boys in the neighborhood, and in addition was used as a footpath by persons walking through the woods.

Sewer "Explodes"

Possibly weakened by these forces, the sewer was unable to withstand the extreme internal pressure created by the flood water. When it failed, the structure actually exploded, throwing large pieces as far as 50 feet. In all, a total length of approximately 150 feet of the sewer was destroyed.

After an inspection of the damage, the author contacted several suppliers of pipe concerning possible dates of delivery. Speed was extremely important on this job because another storm of equal intensity could have caused a flood and considerable additional damage.

Receiving a delivery promise of one week, the city immediately placed an order with Armco Drainage & Metal Products, Inc. for 150 ft. of 84-in. pipe, coated and paved with asphalt. In addition to arriving two to three weeks earlier than other materials, the corrugated metal pipe saved the city approximately $11.00 per foot under the next higher-priced pipe.

While waiting for the pipe to be delivered, the city cleaned up the debris and prepared the site for installation of the metal pipe. This preparation consisted of removing the broken edges of the top half of the structure and cleaning out the bottom half. By leaving the bottom half in place, the sewer continued to act as an open flume until the replacement had been made. In addition, it served as a curved cradle for the corrugated metal pipe.

Placing the Corrugated Pipe

The corrugated metal pipe was delivered to the job with the bottom half of the coupling bands riveted to the sections of pipe. This facilitated installation and insured a close-fitting job. In addition, the sections of pipe were equipped with lifting lugs to increase the ease of handling.

A corrugated metal manhole was prefabricated into one of the sections of pipe, thereby preventing the necessity of cutting and welding on the job. Another time and labor saving feature was the prefabricated elbows furnished with the pipe. These were made to take care of slight changes in alignment where it would otherwise have been necessary to cut and fit sections of pipe together in the field.

Left—Old Sewer Invert Cleaned Out; Right—Completed Job Showing Corrugated Metal Manhole.

Gunite Transitions

The transition sections between the metal and tile lines were made by attaching 14 gage 2 by 2-in. wire mesh both inside and outside the pipes and then carefully guniting both sides. This simple method made it easy to compensate for the difference in the thickness of the metal and the tile pipes, and resulted in a neat, strong connection.

Approximately three weeks after the day of the explosion, the old tile sewer had been cleaned up and 150 ft. of corrugated metal pipe had been installed to replace the damaged section. The contractor in charge of the installation was Dandry Brothers of New Rochelle. Pat Dandry served as supervisor.

FOUR SERIES OF WEATHER CYCLES

Which Presage a Dry Fall and Winter

by

HALBERT P. GILLETTE*
SAN MARINO, CALIF.

ALTHOUGH planets tend to cause cold-wet maxima in many regions when near heliocentric longitude 289°, the amplitudes (departures from a mean) of those cycles are relatively small. On the other hand the amplitudes of weather cycles in the accompanying table are relatively large, and are larger the longer the cycle. All the important climatic cycles are those in one of the four triplex series of the table or its extensions. In a triplex series of cycles the length of each cycle is exactly three times as long as the next shorter one, the lengths being a geometrical progression series whose ratio is three. The footnote of the table gives some additional information.

The cycles of series A have greater amplitudes than those of comparable lengths in the other series; and this tendency toward dominance of cycles of series A increases as the lengths increase. In an article published in this magazine last March it was shown that the 603-year cycle is one of such great amplitude that it has been responsible for a slowly developing drought of great intensity which will reach its maximum in 1984. This has been intensified in many regions by the 513-year cycle whose maximum warm-dry phase will be due about the middle of January, 1956. The drought has also been intensified by the 441-year cycle whose maximum will be due in January, 1950. On the other hand, a cold-wet maximum of the 67-year cycle will be due in July, 1950; and one of the 123-year cycles in July, 1953; but neither of these has great enough amplitude to offset the drought effects of the 441-year and 513-year cycles, not to mention the 603-year cycle whose maximum dry phase will be due 35 years hence.

Great stationary "permanent" cyclones and anticyclones attain their maximum intensity near peaks of the longer cycles in the table. Since these "centers of action" act oppositely in causing vertical circulation of the air, a drought often occurs in one region about when the opposite occurs in another region. Thus the Bermuda anticyclone may cause a drought in our southeastern states at the time that cyclones migrating from the great cyclone of the Aleutian Islands are causing abnormal rainfall in our northwestern states and elsewhere.

Dryness Has Been Increasing for More than Century

The dryness that has been growing in intensity for more than a century has been most marked in our northwestern states, because the great Aleutian stationary cyclone has been weakening as the 441-year, the 513-year and the 603-year cycles have waned in their intensity. During the waning of the Aleutian and Icelandic cyclones, the Northern Pacific, the Bermuda and the Azores anticyclones have waned also. Consequently, regions under the "control" of these three anticyclonic "centers of action" have tended to become wetter. This anticyclonic "control" is not confined to the vertical movement of air, for tangential winds move horizontally away from them. Those currents are strongest between a great "permanent" anticyclone and an adjacent "permanent" cyclone; the direction of the wind in summer being north between our North American continental cyclone and the Bermuda anticyclone. This explains, I think, the moist tropical air that flows up the Mississippi Valley in summer. A converse southward flow tends to occur in winter between the stationary Canadian anticyclone (turning clockwise) and the Icelandic stationary cyclone (turning anticlockwise). The intensity of these two meridianal currents of air increases near peaks of cycles in the table and it wanes near their valleys.

Although 55-cycle lengths are listed in the table, the problem of forecasting by their aid is not as complex as their number indicates, because there are only 5 series of harmonic cycles. Cycles of half the tabular lengths occur in weather at times, notably in the tropics, but their amplitudes are very much less than those of the tabular lengths. On the other hand, sunspot cycles of half the tabular lengths usually have much greater amplitude than those of tabular lengths; e.g. the celebrated "11-year" spot cycle, whose mean length is exactly 11-1/6 years as shown by the thickness of 3200 rings of the California "big trees" (sequoias) and nearly 4200 annual laminae (varves) in a core taken from the bed of Lake Saki, Crimea.

For reasons that will be given in a forthcoming treatise on "Cycles and Their Causes," I infer that the cycles in the accompanying table are caused by the axial rotation of solar ionospheres whose magnetic poles induce electron currents in one another. The oscillating discharges of electrons between ionospheres cause radio waves that propel solar ions away from the sun, as seen in the tails of comets. By such propulsion that varies cyclically, it seems likely that all orbital bodies of the solar system were evolved.

Increased Electron Activity Also Accounts for Earthquakes

Cyclic increases in electron activity in our atmosphere account not only for weather cycles, but for earthquakes and diastrophic movements of

(Continued at bottom of next page)

Table I

FOUR TRIPLEX SERIES OF HARMONIC CYCLES

Series Peak Date	A 1682.53	B 1699.53	C 1729.53	D 1830.53
Length in Years	603.000	513.000	441.000	369.000
" " "	201.000	171.000	147.000	123.000
" " "	67.000	57.000	49.000	41.000
" " "	22.333	19.000	16.333	13.667
" " "	7.444	6.333	5.444	4.556
" " "	2.481	2.111	1.815	1.519
Length in Days	302.112	257.021	220.948	184.878
" " "	100.704	85.674	73.649	61.626
" " "	33.568	28.558	24.550	20.542
" " "	11.189	9.519	8.183	6.847
" " "	3.730	3.173	2.728	2.282

Footnote: Each cycle in a column is exactly three times as long as the next shorter one. The peak date at the top of each column applies to all cycles in that column. Series A certainly has cycles much longer than 603 years, e.g. 1809, 5427, 16,281 years, etc. The last peak of the 16,281-year cycle was due 7,363 B.C. The Glaciation Cycle is 9 times as long as the 16,281-yr. cycle, and its last peak was due 23,644 B.C.; its peak at the beginning of the Quaternary Age was due 300,358 B.C.

That Series B, C and D have cycles longer than the longest in this table is probable but not yet proven.

Comets of 16⅓ and 13⅔-year periods are at or near perihelion at peaks of the 16⅓ and 13⅔ year cycles, indicating their genesis by solar ions propelled by radiant waves.

*President, Gillette Publishing Co.

The Editor's Comments

Somebody is Playing With Fire

Everybody interested, including industry, seemed satisfied with the Federal Pollution Control Act when it became Public Law 845 on June 30, 1948. Now something is happening in Washington to make us wonder if the recent warnings of the growing usurpation of controls and power by the Federal government, by the venerable and esteemed ex-president of the U. S., Herbert Hoover on his 75th birthday, haven't considerable significance.

Attempts are being made in Washington to extend the power of the Federal government in Public Law 845, through amendments to the act. During the many hearings on the bill, before it became law, one of the principle fears was that the proposed Pollution Control Act was to remove from the States to the Federal government police powers over stream pollution, thereby weakening the hand of the State agencies, and giving to Federal authorities a big stick to wield over industry. All such fears on the part of industry, State authorities, and others interested, were dispelled in the wording of the Pollution Control Act as it was finally drawn and now stands. To wit, P.L. 845 permits Federal action through the U. S. Courts against flagrant polluters, but such cases must first be certified for Federal action by the pollution agency of the State in which the violation occurs.

Now, a bill (HR 4568) has been introduced by Congressman Cook of Indiana as an amendment to P.L. 845. The amendment will permit action by the U. S. Attorney General's office against polluters without the requirement of certification for such action by the State agency charged with the procurement of pollution abatement. The intent of the Cook amendment (HR 4568) would appear to be to concentrate stream pollution control in the U. S. Public Health Service or other Federal agencies.

There is some sugar-coating in the amendment. This takes the form of providing for Federal aid to industry in the nature of loans to industrial establishments for the construction of waste treatment plants and the preparation of reports and plans in connection with pollution abatement. In this same direction, but apparently with no motive other than assisting industry and encouraging pollution abatement, two more bills (HR 5089 and HR 5091) have been introduced by Congressmen Byrnes of Wisconsin and Chatham of North Carolina. These bills, believed to be helpful to many polluters, will permit a constructor of waste treatment facilities to amortize his capital investment for such facilities over a five year period, as a measure of income tax relief.

Another development in the disturbing category has been the introduction of HR 4825 by Congressman Hand of New Jersey entitled "The Navigable Waters Pollution Act," and constitutes an amendment to the "Oil Pollution Act of 1924." The latter gives to the Secretary of War powers to stop pollution of navigable coastal waters by the discharge of oil or other floating greases by vessels. The Hand amendment will extend jurisdiction of the War Department to all inland navigable waters as well as coastal waters. Then, in addition to oil pollution HR 4825 also adds "any refuse matter of any kind, other than ordinary sewage; tar; acids or industrial wastes which may in any manner affect marine life, public health, or produce injurious results affecting persons using the navigable waters of the United States". The bill names, as examples, shore installations such as wharves, manufacturing establishments, and mills of all kinds. It permits the issuance of orders by Federal Courts prohibiting discharges of obnoxious industrial wastes upon complaint from a damaged taxpayer. More strangely, HR 4825 stipulates that the Secretary of War may issue permits authorizing deposit of wastes other than oils, in or adjacent to a navigable waterway, provided it is felt that such discharges or deposits will not prove deleterious to health or injure users of such waterways.

It is clear enough that HR 4825, as well as HR 4568, will immediately interfere with and seriously injure the status of State pollution agencies, as well as confuse all concerned—most especially industry which has accepted P.L. 845 and from all signs since its passage intends to abide by its decrees and make genuine efforts to ameliorate pollution. What then is behind the happenings in Washington which are patently muddying the waters of accomplishment which represents the outstanding stride in anti-pollution efforts ever made in America? We believe that Public Law 845 will work as it stands and at least should be given a fair trial before proposing changes. Could it be possible that these bills HR 4825 and HR 4568 have been introduced in an effort to wreck Public Law 845? If not, then their introducers and backers are playing with a lot of fire—and should be so told.

L. H. Enslow

(*Continued from page 363*)

the earth's crust as a result of magnetism induced therein and in the core. Judged by its density the core probably is mainly molten iron. Molten iron has magnetic susceptibility only one seventy-thousandth that of cold iron, but under the enormous pressure its magnetons may become more orientable, thus increasing the magnetic susceptibility of the fluid metal. I have found an earthquake cycle of exactly 11-1/6 years, which for 1700 years averaged 50% more quakes at the peaks of the treering and varve cycle than at its valleys. I see no way of accounting for these correlations except by electron currents and magnetic forces induced by solar electrons.

Corroborative evidence is had if, as I believe, cyclonic and anti-cyclonic whirls in our atmosphere and that of the sun are examples of the Faraday principle of electromagnetic rotation of electric currents. This theory not only explains why ascending currents of electrons (carrying air) rotate anticlockwise in the northern hemisphere, but also why descending currents rotate in the opposite direction in the two hemispheres, as well as why no such whirls occur near the equators, either of the earth or the sun.

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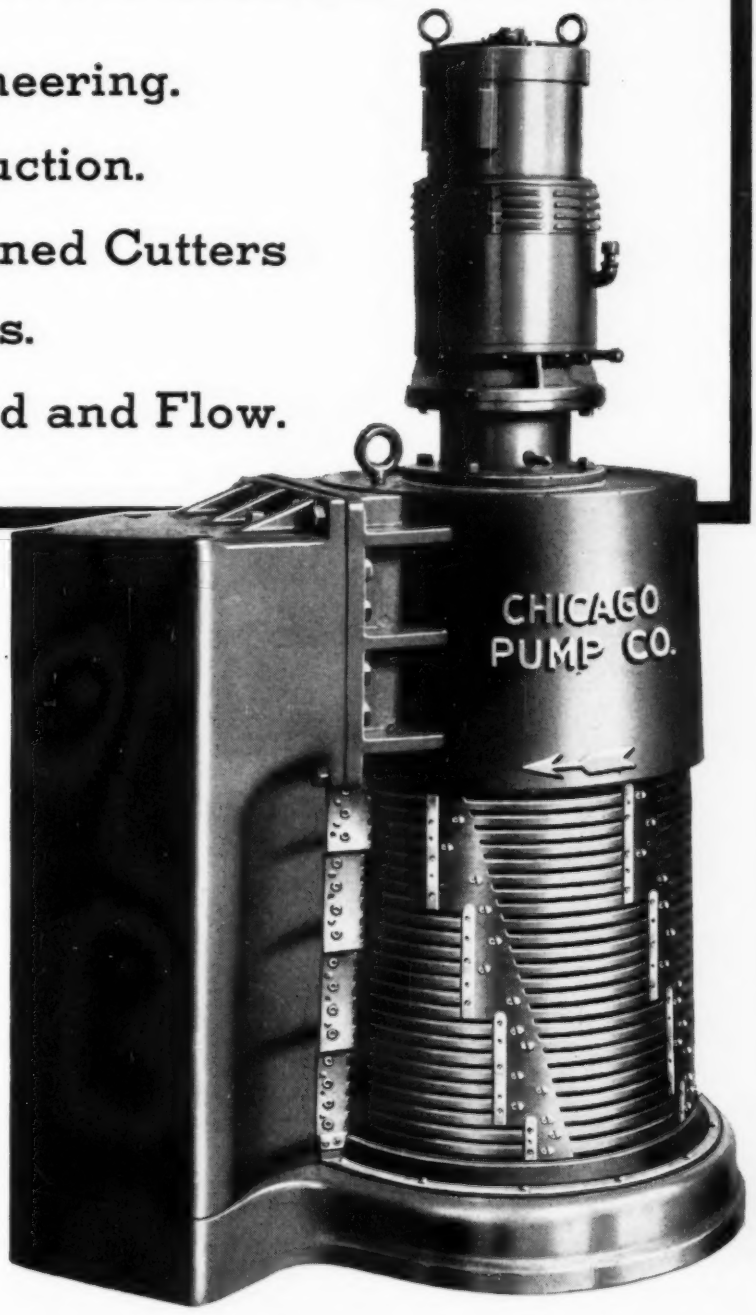

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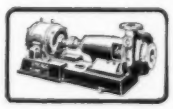

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MEETINGS SCHEDULED

SEPT. 6-7—COOPERSTOWN, N.Y. (Otesaga Hotel)
New York Section, A.W.W.A. Sec'y, R. K. Blanchard, 50 West 50th Street, New York 20, N.Y.

SEPT. 8-9—MINNEAPOLIS, MINN. (Nicollet Hotel)
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, 518 Metropolitan Life Bldg., Minneapolis, Minn.

SEPT. 13-16 — DIXVILLE NOTCH, N.H. (The Balsams)
New England Water Works Association. Sec'y, Joseph C. Knox, 204 Tremont Bldg., Boston 8, Mass.

SEPT. 14-16—HARRISBURG, PA. (Penn Harris Hotel)
Pennsylvania Section A.W.W.A. Sec'y, L. S. Morgan, 415 First National Bank Bldg., Greensburg, Pa.

SEPT. 18-21—KANSAS CITY, MO. (Municipal Auditorium)
American Public Works Association. 1313 East 60th St., Chicago, Ill.

SEPT. 19-23—STATE COLLEGE, PA.
Pennsylvania Water Works School. Director, R. E. Stiemke, Prof. San. Eng., State College, State College, Pa.

SEPT. 20-22—DES MOINES, IOWA (Hotel Kirkwood)
Iowa Sewage Works Association. Sec'y-Treas., Leo Holtkamp, P.O. Box 310, Webster City, Iowa.

SEPT. 21-23—ATLANTA, GA. (Georgia Institute of Technology)
Georgia Water & Sewage School. Sec'y-Treas., Van P. Enloe, R.F.D. No. 5, Box 363, Atlanta, Ga.

SEPT. 21-23—WHEELING, W. VA. (Oglebay Park)
W. Virginia Industrial Wastes & Sewage Works Assn. Sec'y-Treas., R. G. McCall, Dept. of Health, Room 643, State Capitol, Charleston 5, W. Va.

SEPT. 22-23—WHEELING, W. VA. (Oglebay Park)
W. Virginia Section, A.W.W.A. Sec'y, J. B. Harrington, State Dept. of Health, Charleston 5, W. Va.

SEPT. 21—COLORADO SPRINGS, COLO. (Hotel Acacia)
Rocky Mountain Sewage Works Association. Sec'y, Carroll H. Coberly, Room 329, 1441 Welton Street, Denver 2, Colo.

SEPT. 22-23—COLORADO SPRINGS, COLO. (Acacia Hotel)
Rocky Mountain Section A.W.W.A. Sec'y, O. J. Ripple, 426 Cooper Bldg., Denver 2, Colo.

SEPT. 25-27—JOPLIN, MO. (Hotel Connor)
Missouri Section A.W.W.A. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

SEPT. 26-27—REGINA, SASK., CAN. (Hotel Saskatchewan)
Western Canada Water & Sewerage Conference. (1st Convention) Sec'y, H. C. Lindsten, Wallace & Tiernan, Ltd., 301 Bank of Hamilton Bldg., Winnipeg, Manitoba, Can.

MEETINGS SCHEDULED

SEPT. 26-28—SCHUMACHER, ONTARIO (McIntyre Arena)
The Canadian Institute on Sewage & Sanitation. Sec'y-Treas., Dr. A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

SEPT. 28-30—TRAVERSE CITY, MICH. (Park Place Hotel)
Michigan Section A.W.W.A. Sec'y, Raymond J. Faust, State Dept. of Health, Lansing 4, Mich.

SEPT. 28-30—RAPID CITY, S.D. (Alex Johnson Hotel)
South Dakota Water and Sewage Works Conference. Sec'y, W. W. Towne, State Department of Health, Pierre, S.D.

OCT. 3-4—DALLAS, TEXAS (Adolphus Hotel)
National Association of Corrosion Engineers. (South Central Region.) G. R. Olson, Chairman, Box 1407, Shreveport 92, La.

OCT. 5-7—DICKINSON, N.D. (Hotel St. Charles)
North Dakota Water & Sewage Works Conference. Sec'y, Jerome H. Svore, State Dept. of Health, Bismarck, N.D.

OCT. 6-7—BURLINGTON, IOWA (Burlington Hotel)
Iowa Section A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

OCT. 9-12—OKLAHOMA CITY, OKLA. (Hotel Biltmore)
Southwest Section A.W.W.A. Sec'y, L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

OCT. 11-13—MILWAUKEE, WIS. (Hotel Schroeder)
Wisconsin Section A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison 3, Wis.

OCT. 12—OLD TOWNE, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

OCT. 17-19—PITTSBURGH, PA. (Hotel Wm. Penn)
Engineers' Society of Western Penna. Chairman, H. M. Olson, Wm. Penn Hotel, Pittsburgh, Pa.

OCT. 17-20—BOSTON, MASS. (Statler Hotel)
Federation of Sewage Works Associations. Executive Secretary, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

OCT. 17-20—BOSTON, MASS. (Statler Hotel)
New England Sewage Works Association. Sec'y, Walter E. Merrill, State Dept. of Health, 511-A State House, Boston, Mass.

OCT. 19-21—JACKSON, MISS. (Heidelberg Hotel)
Alabama-Mississippi Section A.W.W.A. Sec'y-Treas., J. L. Snow, 601 First National Bank Bldg., Montgomery, Ala.

OCT. 24-25—ROANOKE, VA. (Roanoke Hotel)
Virginia Section A.W.W.A. Sec'y, W. H. Shewbridge, 713 State Office Bldg., Richmond 19, Va.

OCT. 24-25—POCONO MANOR, PA. (Pocono Manor Inn)
Pennsylvania Municipal Authorities Association. Sec'y, Charles F. Lee Decker, 103 Sparks Bldg., State College, Pa.

OCT. 24-28—NEW YORK, N. Y. (Hotels Statler & New Yorker)
American Public Health Association. (Annual Meeting) Exec.-Sec'y, Dr. Reginald M. Atwater, 1790 Broadway, New York, N.Y.

OCT. 26-28—ATLANTIC CITY, N.J. (Hotel Claridge)
Pennsylvania Water Works Association. Sec'y, C. M. Hartman, 279 Boas St., Harrisburg, Pa.

OCT. 26-28—SACRAMENTO, CALIF. (Hotel not selected)
California Section A.W.W.A. Sec'y, H. C. Medberry, San Francisco Water Department, Millbrae, Calif.

OCT. 31-NOV. 2—LEXINGTON, KY. (Hotel Phoenix)
Kentucky-Tennessee Section A.W.W.A. Sec'y, R. P. Farrell, 420 6th Ave., Nashville, Tenn.

NOV. 2-4—WASHINGTON, D.C. (Wardman Park Hotel)
Chesapeake Section A.W.W.A. (1st Annual Convention) Sec'y-Treas., C. J. Lauter, 5902 Dalecarlia Place, Washington, D.C.

NOV. 3-4—DAYTON, OHIO (Hotel not selected)
Ohio Section A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 13, Ohio.

NOV. 7-9—SOUTHERN PINES, N. C. (Highland Pines Inn)
North Carolina Section A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

NOV. 11-13—YUMA, ARIZ. (San Carlos Hotel)
Arizona Section A.W.W.A. Mrs. Helen Rotthaus, State Department of Health, Phoenix, Ariz.

NOV. 14-16—ORLANDO, FLA. (Orange Court Hotel)
Florida Section A.W.W.A. Sec'y, A. E. Williamson, Jr., P.O. Box 1431, Daytona Beach, Fla.

NOV. 17—BOSTON, MASS. (Hotel Statler)
New England Water Works Assn. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston 8, Mass. (Next meeting Dec. 15th.)

NOV. 17-19—ATLANTIC CITY, N.J. (Hotel Madison)
New Jersey Section A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark, N.J.

DEC. 5-7—ALBANY, GA. (Gordon Hotel)
Southeastern Section A.W.W.A. Sec'y, T. A. Kolb, Room 433 Wade Hampton Office Bldg., Columbia, S.C.

DEC. 14—AUGUSTA, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

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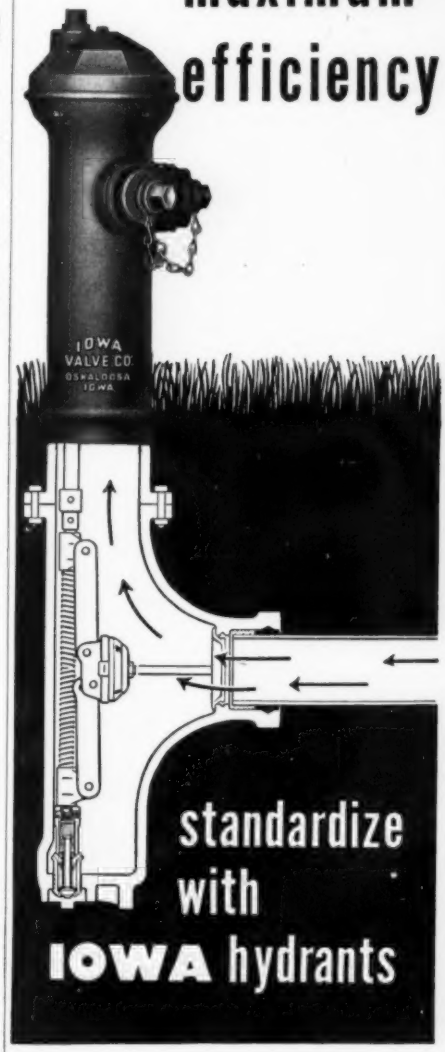

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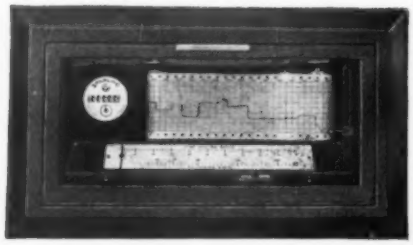

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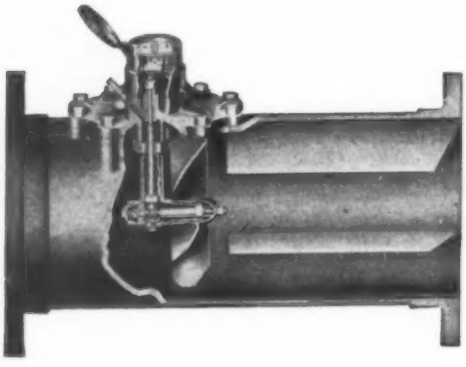

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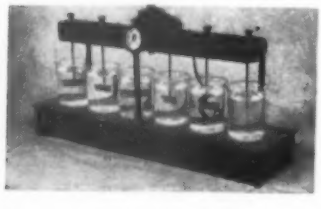

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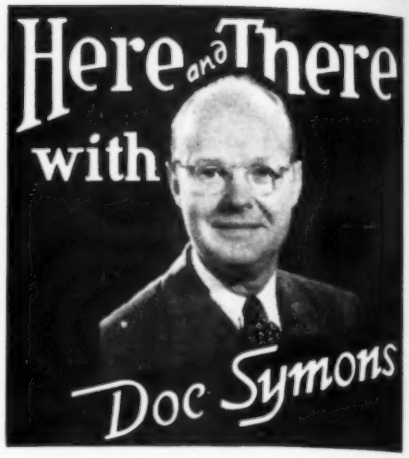

H.T.M.A.—And just as though you hadn't had enough of the story about the A.W.W.A. Convention in Chicago, I'm going to tell you some more.

* * *

Almost everyone at the Convention took a look at the exhibit of Antiques, including the 1800-year-old piece of lead pipe laid in Rome about 60-70 A.D. There were some mighty interesting items showing the history of early waterworks practice in this country. Prominently displayed in the exhibits, under the caption "Waterworks Antiques," were pictures of Harry (A.W.W.A.) Jordan and Arthur T. (W.S.W.M.A.) Clark.

* * *

After the dinner dance, the Society of Council Bluffers held its annual meeting and breakfast. With the exception of Sam (Sam II, Elizabeth, N.J.) Newkirk, every member was there: Harry (Permutit) Boehner, A.E. (W & T) Griffin, "Casey" and "Dot" (Simplex Valve) Jones, Wendell and Tina (Akron, Ohio) La Due, Dan and Lillian (Permutit) Saunders, Jack and Mary (R. B. Carter) Van Atta, and Secy. "Doc" Symons. Also present were three associate members, "Dottie" (Mrs. Harry) Boehner, and Reg and Beulah (Hydrotite) Hayes.—Here is a very poor picture (shot at f-2.7, 1 sec.) of

the distaff side of the group. The car behind was that used to pace the Indianapolis 500 mile race.

According to the bylaws of the organization, the President is elected by

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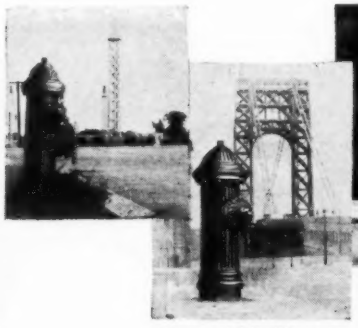

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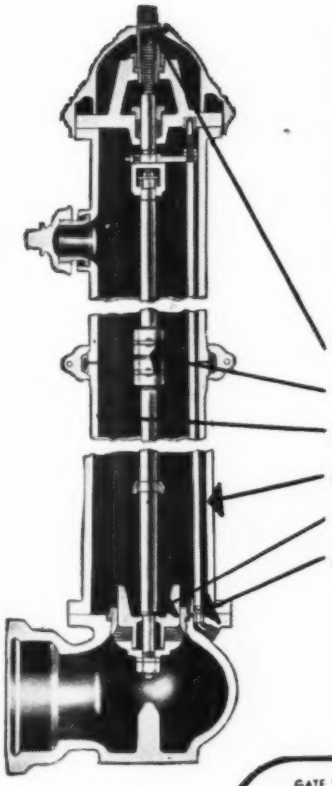

New York—Philadelphia—Washington—Baltimore—St. Louis—Providence and scores of other cities throughout the nation use SMITH hydrants—and not without good reason. A few of these reasons can easily be seen upon inspection of the hydrant section shown at the left.

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2 Frangible couplings for collision protection.
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4 Tapered, frost-proof barrel
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6 Positive action drain—always closed when main valve is open.

31

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playing "Honest John." The Asst. Pres. is elected in the same manner but there is a slight difference. The President gets stuck with the check for breakfast, and the Asst. Pres. gets stuck with the tip. "Casey" Jones (one of the Maxwell Twins) got the breakfast tab, and Jack Van Atta the tip. All hail the new President and Vice President—And we're off for another year.

* * *

Remember last month when I was mentioning a few more eating places, I made reference to Matt Shulein's out on North Halsted St.—It was there that I saw John (A. P. Smith) Atwell, Seaver (Centriline) Jones, the "Jim" (Trojan Tool) Brown's of Chicago, and Carl Eberlin of Cincinnati. It was there, too, that I also saw this proverb, "HERESTO PANDS PEN DASOCI ALHOU RINHAR M LES SMIRT HAND FUNL ETFRI ENDS HIPRE IGN BEJUS TAND KINDAN DEVILS PEAKOF NO NE."

* * *

Down on the Exhibit Hall floor one day I ran into John and Mrs. Pritchard. He's a consulting engineer, you know, in St. Louis. She's a bit of a consulting engineer herself. At least down in Magnolia, Miss., where she has a dairy farm, she has developed a well, and laid out and supervised the installation of a sewer line. These waterworks wives are clever as well as attractive.

* * *

In one of the sessions, when the subject of water works operation under city manager forms of government was being discussed, one of the speakers was Reeves Newsom, Village Manager of Scarsdale, N. Y. Reeves recounted all of the advantages of the Village Manager setup, and how well the water department functioned under the system. When he finished and sat down in the audience, Walter Pierce of Racine, Wis., leaned over and said: "What do they have in Heaven that you don't have?"

* * *

Talk about devotion to one's job—Walter Bixler, Philadelphia Representative of the Flexible Underground Pipe Cleaner Co., was married on Saturday and arrived at the Convention on Sunday.—I don't know where you'd find any nicer group of people with which to spend your honeymoon.

* * *

As most everyone (or at least every one who attends A.W.W.A. conventions) knows, Bernal Swab, a consulting engineer of Toledo, and Art Welch, the Nuchar man from Philadelphia, are both home movie addicts. Last year at Atlantic City they took as much footage as the rains would allow. These films were combined and shown several times in Chicago, on request.

Seeing ourselves as "ithers" see us is sometimes a shock, sometimes a pleasure, but never uninteresting. In the scene in which I appeared, I doffed my hat as I passed before the camera. Bernal told me that at one showing, when that particular act appeared on the screen, some one in the audience remarked, "That's where he made his mistake!"—O.K., so I do look younger with my hat on.

* * *

Small World No. 9—One night some of us were talking to Mr. and Mrs. S. T. (Springfield, Ill.) Anderson and I remarked, "I once lived in a suburb of Springfield—Riverton". Up spoke Bob Browning of Electro Rust Proofing Co. (Newark) and said, "I'll bet you knew my wife, she's from Riverton."

Bob's wife turned out to be Linda Wilke, whose father owned the corner grocery store when I was a very small boy. Digging back a few decades in

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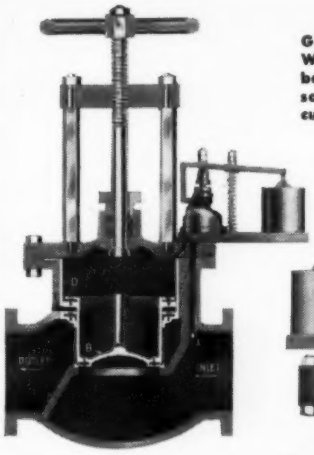


G-A Electric and Manual Water Service Valve may be operated either by a solenoid on AC or DC circuit or by the handwheel.

G-A Water Service Valve is designed with renewable cups and seat washer to eliminate metal to metal contacts.

ON YOUR SERVICE LINES . . .

GA

Golden-Anderson

ELECTRIC AND MANUAL

WATER SERVICE Valves

For the dependable flow control you need, specify Golden-Anderson Water Service Valves. Ideally suited for any spray service requirement or for remote electrical control, they are manufactured with perfect air and water cushioning to eliminate water hammer and shock in automatic operation. They may be arranged to operate either when solenoid is energized or de-energized. Both types are furnished in globe or angle patterns. These highest quality valves are available in cast iron, semi-steel and cast steel with non-corrosive trim of bronze, Gavalloy or stainless steel. Write for more details.

Golden-Anderson *Valve* SPECIALTY CO.

Keenan Building, Pittsburgh 22, Pa.

LIFE AND PROPERTY PROTECTION VALVES SINCE 1905

our childhood memories, we decided that as children we had played together on the banks of the Sangamon River, where the Jimson weeds grew.—Small World!

* * *

Have you ever felt the urge to pull the emergency cord on a railroad train?—Well, I shook the hand that did it on the "Water Works Special" coming back to New York. There were sixty-six of us aboard the train and every one was at the station in plenty of time, although my porter just made it with my bag as the train pulled out.

I went immediately into the Club Car for a Coke to calm my nerves after that harrowing experience of wondering if my bags would get aboard. I was hardly seated when the train shuddered to an abrupt halt.—Some one had pulled the emergency cord.—Within the next ten seconds there was a procession running through the Club Car. It was headed by Charlie (Montclair, N.J. Water Supt.) Bourgin, and following him were Frank (R. D. Wood Co.) Harmstead, Harry (Permutit) Boehner and two or three others. Charlie was shouting "Our bags are out there on the platform."—Seems as though their porter was not as successful as mine. I learned later that it was Harry Boehner who first pulled the emergency cord, and then they all pulled it.—Except for a few more gray hairs there was no damage done.

* * *

It was Harry Boehner, too, and his wife, Dottie, who taught "Bill" (*American City*) Foster and me a new card game, using only three cards and called "Thirty-One"—Oh! Well, I only lost thirty cents.

* * *

Very much in evidence on the return trip was "Conductor" E. A. (Nuchar) Sigworth, who I learned is a bit ticklish. "Siggie" is as you know the official and perennial chairman of transportation for the A.W.W.A. Conventions.—It's fellows like "Siggie" who do a neat job of committee work each year that help make all of these conventions a success. Evidently being ticklish doesn't slow up his effectiveness as a transportation chairman.

* * *

Of course we missed Earl Biddle of the Pennsylvania Railroad who usually is present on these "Water Works Specials" to see that everything is satisfactory and the service O.K. Earl was hospitalized just before the convention this year. In his place was a very pleasant young fellow named Johnny Brooks. He stopped in my room on the way back and we had a long chat about photography.—The Pennsy service was O.K., thanks to Johnny, but doggone, I wish the P.R.R. dining car service would serve drinking water out of water bottles that are not full of dirt.—Well, they weren't exactly full of dirt, but there was a lot of some extraneous matter on the bottom, and the water wasn't exactly crystal clear.

* * *

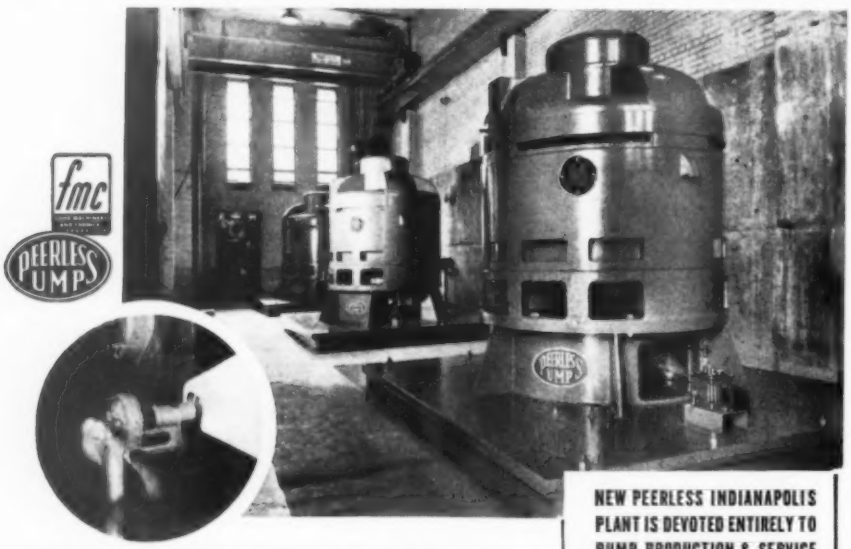
During one of the sessions E. B. Mayer, of the Los Angeles Water and Power Dept., made a suggestion to eliminate tastes and odors, hard water, corrosion, etc. etc. etc.—He suggested that we pipe hydrogen and oxygen to the taps of the consumers, and there to combine it to produce pure water.—Hmmmm——well, it sounded funny at the time.

* * *

And that just about completes the story of the A.W.W.A. Convention this year. Although you won't be reading this until September, publishing deadlines being what they are, I shall have had a vacation and written the October column before then.—I hope.—See you around this fall.

V.T.Y.—Doc.

WIDEST CAPACITY RANGE



FROM A COMPREHENSIVE LINE OF VERTICAL AND HORIZONTAL PUMPS

Peerless offers 2 to 220,000 gallons per minute

A tapful or a torrent! No matter what your water capacity requirements are, Peerless can meet your pumping needs.

Fractional hp horizontals, like the Peerless "Fluidyne" pumps handling cooling-jacket water in the inset above, furnish a few gallons a minute. The huge Peerless mixed-flow pumps in the larger photo, pump away drainage water at a rate of tens of thousands of gallons a minute.

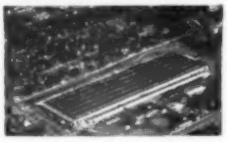
Widest capacity range is but one of a host of reasons why industries, municipalities and commercial businesses plan with Peerless for all their needs for pumps. Here are others:

ALL PRACTICAL HEADS: Lifting water from 1000 feet or more is a practical accomplishment of Peerless vertical deep well pumps. Pumping against heads of 690 feet is a common task for Peerless horizontal centrifugal pumps.

ALL TYPES OF DRIVE: Electric motor, right angle gear, engine, belt (V or flat) or combinations of the above, are all available from Peerless, with pump and driver engineered as a unit.

MODERN DESIGN: Peerless pumps are designed for top flight performance over extended periods of time. And the practical consideration of ease of maintenance is figured in to their functional, good looking design.

NEW PEERLESS INDIANAPOLIS PLANT IS DEVOTED ENTIRELY TO PUMP PRODUCTION & SERVICE



Here is one of America's newest pump plants—19 acres of modern manufacturing facilities devoted to precision production of horizontal and vertical pumps, located at Indianapolis. Plan with Peerless for pumps plus fast, comprehensive pump service.

NATIONWIDE SERVICE: Peerless sales and field service are available in all principal U. S. cities and abroad. Plan with Peerless for all your pumping needs. Individual bulletins on all types of Peerless Pumps are available upon request.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Los Angeles 31, California — Indianapolis, Indiana
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 North Broadway; Atlanta Office: Rutland Bldg., Decatur, Ga.; Omaha, Nebraska, 4330 Leavenworth Street; Dallas 1, Texas, 3905 Elm Street; Fresno, California; Los Angeles 31, California

Peerless
VERTICAL AND HORIZONTAL
Pumps

They are the result of the closest kind of coordinated engineering and construction . . . requiring infinite capacity for attention to every detail from blueprint through the finished job . . . keen perception of economies in terms of sound, proved principles . . . integrity which gives peace of mind through the years . . . engineering and production facilities that reflect credit to every component no matter how small . . . and last but by no means least, a long, enduring, and constant personal association with the building and installing of dependable equipment.

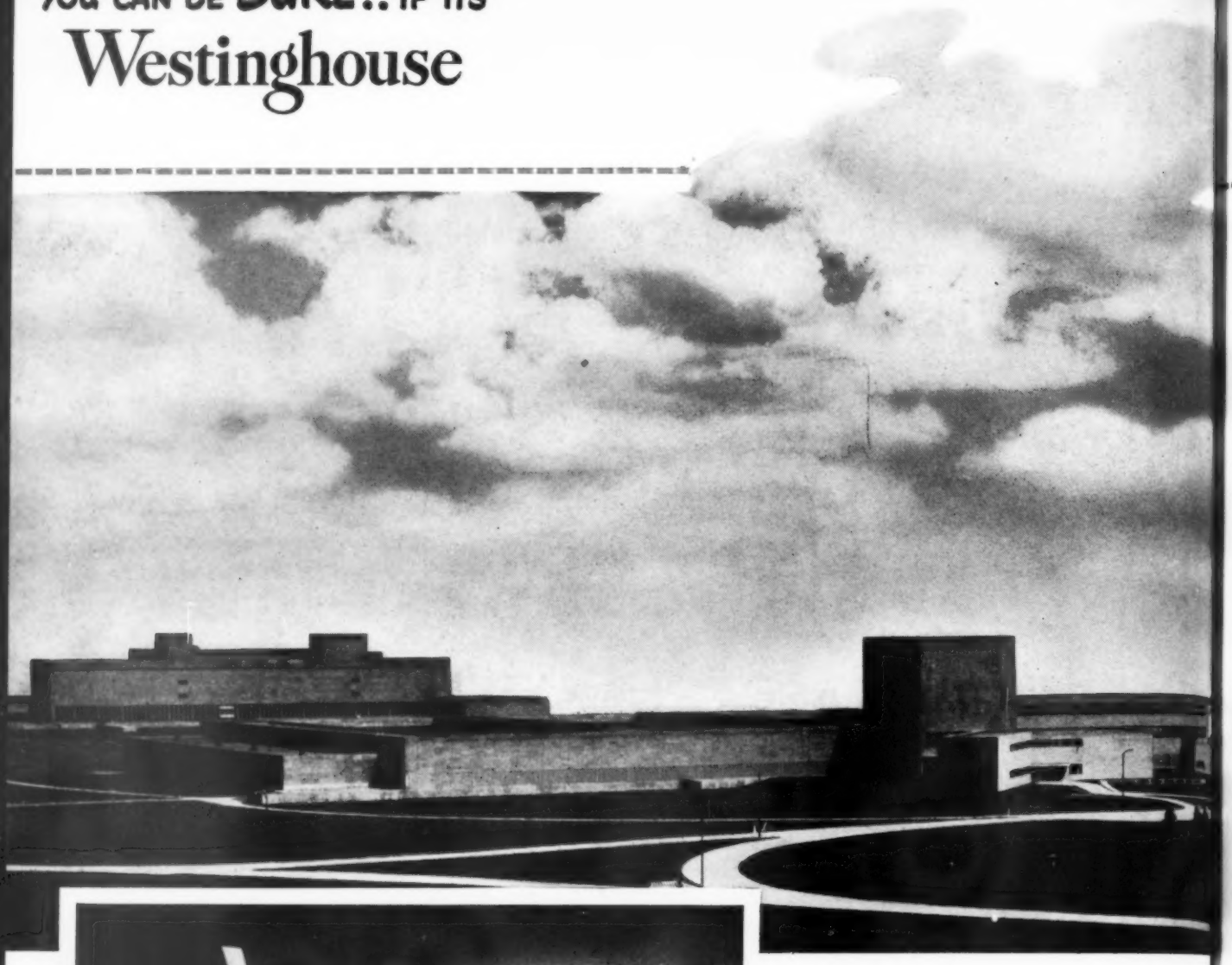
THE NAMEPLATE OF

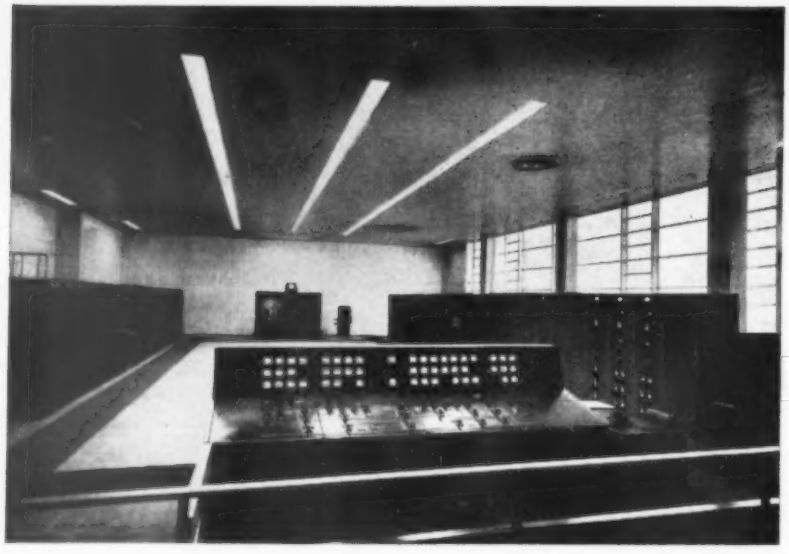
DEPENDABILITY

ROBERTS FILTER MANUFACTURING CO.
607 COLUMBIA AVENUE, DARBY, PENNA.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





The Chicago South District Filtration Plant shown here is the largest in the world, serving more than a million and a half people. The plant has operated at an hourly peak of 546 mgd with only 70 of the 80 filters in service.

This mezzanine switchgear room in the lower left pumping station is an example of the way Westinghouse designs and manufactures electrical equipment for a co-ordinated, efficient system. (Right) High-voltage switchgear gives necessary protection on incoming lines, as well as feeders, and supplies power to large pump motors and station transformers. (Left) Low-voltage switchgear controls station auxiliaries such as priming pumps, crane motor feeder and valves. (Rear center) Network protectors and 120/208-volt distribution for building lighting and miscellaneous power. (Front center) Control desk with mimic bus, indicating instruments and circuit breaker switches centralizes control of plant equipment.

Westinghouse

EQUIPMENT FOR PUBLIC WORKS

Unit Responsibility

ASSURES WATER WORKS EFFICIENCY

For any water works, large or small, higher operating efficiency depends in part on your electrical manufacturer.

He should provide every type of electrical equipment . . . give you a co-ordinated engineering application . . . based on practical experience in water works electrification.

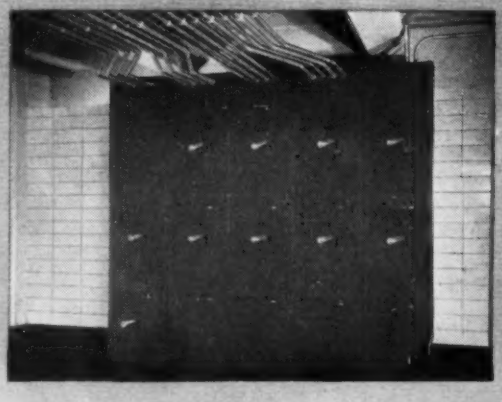
These elements add up to unit responsibility and mean reduced operating costs for your plant. You get them all from Westinghouse:

Westinghouse makes a complete line of electrical equipment for water works. This includes "Unitized" metal-clad switchgear; packaged power centers, power transformers and unit substations; control and control centers; motors and gearmotors, as well as other electrical apparatus and supplies.

Westinghouse Consulting and Application Engineers are available to work with you. They will help you select and apply the right equipment to give you a co-ordinated, efficient electrical system.

Westinghouse brings you a background of long experience in applying electrical equipment to water works. The Chicago South District Filtration Plant, shown here, is but one more in a large list of outstanding installations where Westinghouse unit responsibility has been *proved* on the job.

For help on your water works electrification problems, call your nearest Westinghouse District Office, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-94818



This control center on the third floor of the Chemical Building groups into one unit all the combination linestarters and motor control for fan motors, agitator drives and other auxiliary equipment in this plant area.

These two 300-kva, 3-phase, 60-cycle, 2300/120-208-volt, liquid-filled distribution transformers are located in the west pump room and supply power for the building lights and equipment in the Filtration Plant.

Extra Speed

THREADING 1" to 2" PIPE

RIDGID No. 65R
is semi-automatic, sets to pipe size in just 10 seconds

● The RIDGID 65R is so handy and efficient that it's actually a pleasure to use. In just 10 seconds you're ready to cut perfect threads on 1," 1¼," 1½" or 2" pipe. Workholder sets instantly—only one screw to tighten, no bushings. With the self-contained RIDGID 65R you don't have to bother with extra dies—one set of high-speed steel chaser dies gives you accurate threads on any kind of pipe or conduit, always—easily. Every 65R is factory-tested. Buy from your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

THE SPILLWAY

[Overflow from the main section]

Annual Reports of Interest

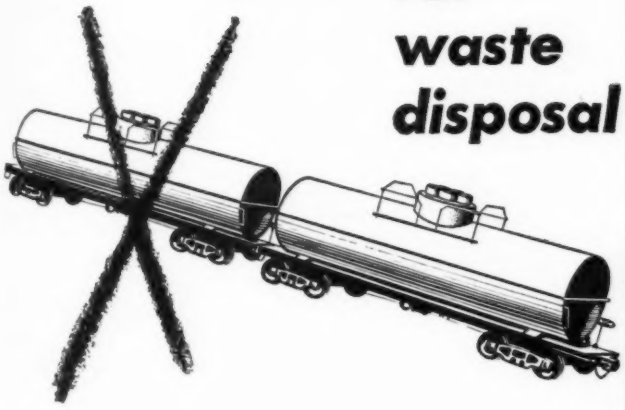
The following brief abstracts have been made of annual reports received within recent months. Copies of the reports may be obtained by writing to the superintendent of the department or plant in question.

WATER SUPPLY

Louisville Water Co. 1948. (96 pages). B. E. Payne, Chief Engr. & Supt. Total number of services, 83,814, an increase of 2,748 over the previous year. Purification plant output 60.3 mgd. Wash water used, 1.89 per cent. Percentage of water softened 82.3. Operating expense totals 8.35 cents per thousand gallons. Tables give operating data on two pumping stations, purification plant, and on office operation, installation of mains, etc., as well as the fiscal officer's annual report.

Honolulu, Hawaii. 1947-48. Biennial. (142 pages, part diagrams). Frederick Ohrt, Mgr. and Chief Engr. Report discusses ground water supply, salt water encroachment, artesian wells, etc. Pumpage 34.5 mgd. in 1947; 32.5 mgd. in 1948. Cost of operation for each of six pumping stations given. 64 main breaks in 1947 and 78 in 1948 on mains of 4 in. diameter and larger. Equivalent to 0.2 breaks per mile of main in 1947 and 0.23 per mile of mains in 1948. Five year meter testing program brought up to date. Approximately 25,000 meters handled in the two-year period. Total number of consumer services, 30,912. The report is amply illustrated. Sections are devoted to construction, project planning, administration, public relations, personnel, etc. Revenue dollar spent, 53 per cent for salaries and wages, 5 per cent for fuel and power, 15 per cent for materials and services, 16 per cent for depreciation of plants, 8 per cent for interest, and 3 per cent for reinvestment. More than half the book is devoted to tables and data on operation of the various departments.

pH Control for waste disposal



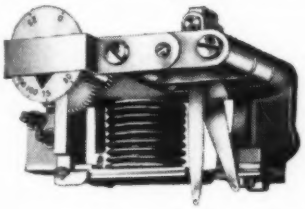
a miser on make-up chemicals

If you are planning a waste disposal system using spent acid to neutralize used alkali, here's pH control that is a money-saver. Instead of controlling to a fixed pH by frequent addition of make-up acid or alkali to offset varying quantities of wastes being blended, this system varies the pH control point, within legal limits.

By proper application of standard and thoroughly-proven Foxboro Instrumentation, the use of additive chemicals is minimized or completely eliminated. This in turn permits the use of small tanks for whatever make-up chemicals are needed.

Complete details of this cost-saving application are available in Bulletin III of the Foxboro Industrial Waste Disposal Series. Write **The Foxboro Company, 228 Neponset Avenue, Foxboro, Mass., U. S. A.**

Typical Feature of Foxboro Instruments that simplifies automatic pH Control



Here is the Pneumaticset mechanism that automatically shifts the control point of the Model 40 Controller, within predetermined limits, to assure optimum use of neutralizing chemicals. It operates on pneumatic impulses received from another instrument which continuously measures the ratio of acid to alkali wastes in storage awaiting treatment.

FOXBORO® Instrumentation

INDICATING · RECORDING · CONTROLLING

LONG-LASTING PAINTS

Save Expense of Frequent Repainting

Inertol Enamels applied 13 years ago have not needed repainting since

Eagle Grove, Iowa, Water Works where Inertol's colored enamels have given trouble-free performance for the last 13 years. Colors beautifying the Eagle Grove Water Works: White for submerged concrete; Buff for walls and ceilings; Battleship Grey for floors; Dark Green for pipes and motors.

Currie Engineering Company's original specifications for this plant:

Metal: Submerged work shall be given two finish coats of paint equal to that manufactured by Inertol Co., Inc., under the trade name of "Inertol 49 Thick."

Concrete: The entire inside of the clear well, mixing tanks, clarifier, recarbonating basin, and filters shall be given two coats of paint equal to "Torex Enamel."

Wood and Plaster: All wood trim and all plastered walls and ceilings of the filter and clarifier operating rooms shall be given one priming coat and two finish coats. The paint used shall be equal to "Ramuc Utility Enamel."

LOW IN OVER-ALL COST! Only 25% of the cost of a paint job goes for the paint itself. 75% goes for labor. That's why it's sound economy to specify these high-quality, long-lasting coatings that put your **next** painting far, far ahead in the future.

Drop us a post card for "Painting Guide." FREE!

INERTOL CO., INC.

19 South Park, San Francisco 7, Calif.

480 Frelinghuysen Ave., Newark 5, N. J.

Augusta, Me., Water District. 1948. (46 pages). Sidney S. Anthony, Supt. & Engr. This is the 44th annual report of the Water Dept., and includes two pie-shaped graphs showing where money comes from and how it is spent. 118 new service connections were installed during the year and 8,000 ft. of new water main. Daily production 2.66 mgd. Operating expense includes .3 per cent for distribution, 9.6 per cent for pumping, 3.00 per cent for purification, 1.74 per cent for water supply. Interest on bonds, reduction of debts, general expense, additions to plant, and general expense make up the remainder of the cost of operation. The report includes pictures of recent additions to buildings and equipment.

Athol, Mass. 1948 (22 pages). R. W. Glasheen, Supt. Consumption, 905,386 gpd. Number of meters, 2,256. 98.32 per cent metered. 4,623 ft. of pipe installed plus 345 ft. of 6 in. pipe replacing 4 in. pipe. Bonds outstanding amount to $2,000. Reforestation program continued, 8,900 trees being set out. Income $108,966.00. Expenditures $62,913.00.

Hartford, Conn. 1947 (108 pgs.). Warren A. Gentner, Deputy Mgr. and Ch. Engr. Estimated population supplied, 312,000. Average consumption of water, 31.5 mgd. Total income sale of water, $1,748,463.00, of which $363,494.00 was from industrial sales only. Both showed an increase. Distribution of revenue dollar, source of supply, 6.4 cents, purification system, 3.9 cents, distribution system, 10.6 cents, administration, 15.8, accounting, 3.5, depreciation, 15.1, and fixed charges, 39.9.

The book contains complete tabular data on main pipe extensions, costs, services, consumption, analysis, and bids.

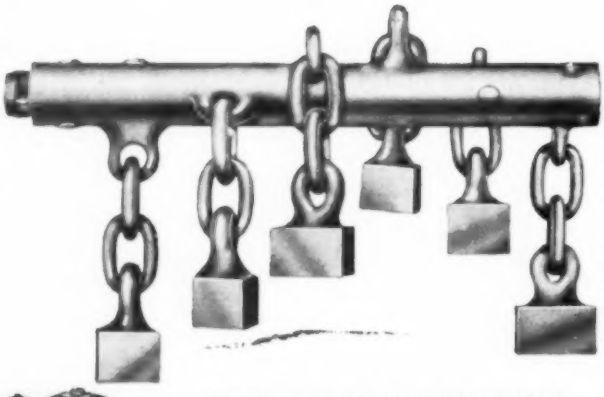
Detroit, Mich. 1947-48 (84 pages). L. G. Lenhardt, Gen. Mgr. Per capita pumpage, 147 gal. per day. Distribution of waterworks revenue dollar shows 26 cents to wages, 31 cents to service, 26 cents to replacements and improvements, and 17 cents to operation and maintenance. Outstanding debt is 36 million dollars. Distribution of water sold shows approximately 26 per cent to domestic service, 18 per cent to commercial service, 22 per cent to industry, 17 per cent to suburbs; leakage, 4 per cent, and unaccounted for water, 9.1 per cent. The revenue per thousand gallons of water pumped averaged 59 cents. The revenue per thousand gallons of revenue-producing water pumped was 70 cents.

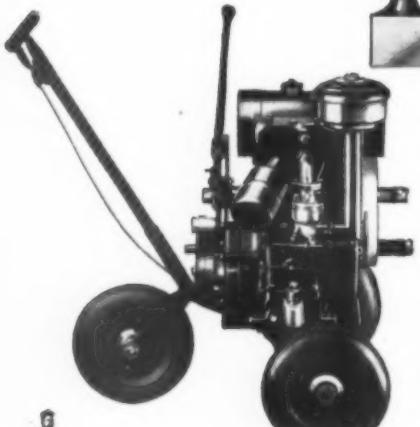
This report also includes a summary of sewage treatment plant operation which is part of the Water Dept. Total population is approximately 2,500,000 persons. Average pumpage is approximately 400 mgd. Plain sedimentation and chlorination are used. Approximately 212,000 wet tons of sludge were burned during the year. Chlorine demand 6.18 ppm. Total chlorine used 2,311 tons. Bacterial kill approximately 75 per cent.

Portsmouth, Va. 1948 (24 pages). X. D. Murden, Supt. Daily pumpage slightly over 10 mgd. 64,402 ft. of mains laid including 243 valves and 86 fire hydrants. 2,425 meters purchased. The cost of betterments shows the increase in capital improvements made from revenue in the past 30 years to be approximately $80,000 per year. Operating costs increased 17 per cent, most of which was due to the increased cost for other city services. Actual op-

PRACTICAL PIPE LINE CLEANING TOOLS FOR PRACTICAL MEN

"Flexible" Power Tools for Cleaning Pipe in Short Sections—in Diameters Ranging from 4 Inches to 12 Inches.





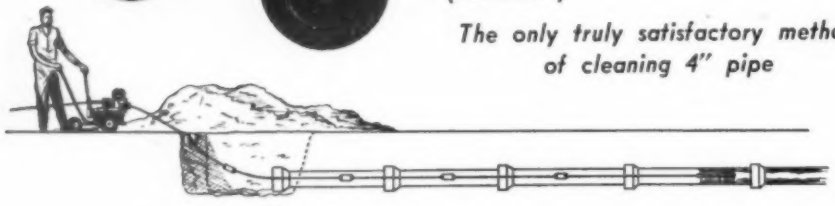
"FLEXIBLE" CHAIN HEAD AUGER

Cleans right down to the metal. Has never been known to break a pipe or damage a corporation cock. (Patented.)

"FLEXIBLE" POWER DRIVE

Powerful, portable power drive unit. Simple, safe to handle. Furnished with dependable 4 H.P., plus engine. (Patented.)

The only truly satisfactory method of cleaning 4" pipe



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Ferri-Floc
FERRIC SULPHATE
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...of a Superior COAGULANT

SEVEN ADVANTAGES OF FERRI-FLOC

1. Coagulation is effective over a much wider pH range than with other coagulants. Color flocs may be formed in the very acid range where other coagulants may not be employed. On the other hand, true hydrated ferric oxide flocs may be formed at pH 9-10 or even higher for the removal of turpidity and manganese.
2. The time required for floc formation, conditioning and settling is in many cases considerably shorter than that required for other coagulants.
3. Filter runs have been markedly increased in several cases.
4. Manganese is successfully removed at pH values above 9.
5. Effluents may be produced which are exceedingly low in both iron and aluminum.
6. Hydrogen Sulphide is removed and taste and odors improved.
7. Ferri-Floc does not seem to stick to sand grain to form mud balls, and is subject to less "breaking through" on the filters.

Let us send you FREE, this valuable booklet on Ferri-Floc.
Write TENNESSEE CORPORATION,
Grant Bldg., Atlanta, Ga.

Many of the country's larger plants are now recognizing the advantages offered by Ferric Coagulants and are taking advantage of them through Ferri-Floc. — Ferri-Floc eliminates the troubles encountered with other coagulants by improving general quality, reducing overall cost. — All of this is accomplished without costly changes in plant equipment.

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Atlanta, Georgia — Lockland, Ohio

THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

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Complete Service for Elevated Water Tanks—
Nation Wide Service—30 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

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SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

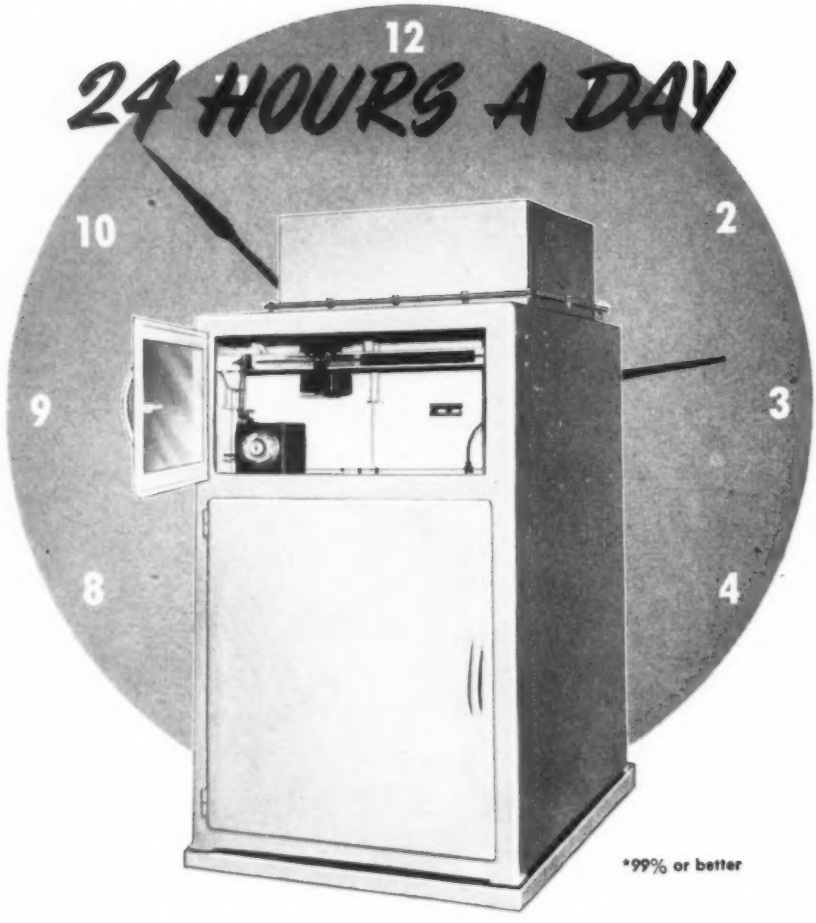
erating increase was less than four per cent, part of which was due to an increase in the price of chemicals. Unaccounted for water, 12.2 per cent on the Portsmouth Div., 22.2 per cent on the Suffolk Div. Cost of operation, 17.6 cents per 1000 gal. Revenue, 22.9 cents per 1000 gal.

Greenville, S. C. 1947-48 fiscal year. Auditor's Report. Net operating profit, $349,300.00. Expenditures, $304,448.00 including retirement of bonds. Excess profit, $44,852.00.

SEWAGE TREATMENT

Rochester, Mich. 1948. R. D. Craun, Supt. Average flow 480,900 gal. per day. Settleable solids reduced 94.8 per cent, suspended solids 66.5 per cent, and five-day B.O.D., 58.6 per cent. Parke Davis Co. Biological Farms, which runs higher in B.O.D. and suspended solids, constitutes 3.5 per cent of total flow. Public relations efforts successful and new road opened to the plant drew a large number of visitors. Landscaping under way.

GUARANTEED ACCURACY*



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VOLUMETRIC FEEDERS
GRAVIMETRIC FEEDERS
SOLUTION FEEDERS
LIME SLAKING EQUIPMENT
BUCKET ELEVATORS
LABORATORY STIRRERS

THE LAST WORD IN FEEDERS
OMEGA

Linden-Roselle, N. J. Sewerage Authority. Fiscal year ending Jan. 31, 1949. Franklin Hudson, Chairman. This is the first annual report. Contains the history of the project, by-laws of the Authority, description of the project, plans of the treatment works, and a description of the plans and estimate of cost. Plant not yet constructed.

Oshkosh, Wisc. (Fiscal year Oct. 31, 1948). Mimeographed. R. W. Frazier, Mgr. Population 45,000. Five-day B.O.D., 248 ppm. reduced by 40.5 per cent. Settleable solids reduced 98 per cent. Gas engines operated 8,666 hours produced 334,800 K.W.H. At public utility rate, equivalent to $4,594.00, a net saving amounting to $3,179.00. Sludge sales amounted to $572.00.

WATER & SEWAGE TREATMENT

Alliance, Ohio. 1948 (61 pages mimeographed). Donald D. Heffelfinger, Engr.-Supt. Water pumpage, 5.9 mgd. Water income totaled $225,153.00. Sewage fund receipts amounted to $50,226.00. Expenditures for water, $231,456.00, sewage treatment, $26,728.00, sanitary sewer fund, $45,201.00. Water Dept. operated at a deficit of $18,555.00. 66.7 per cent of water pumped is metered.

Sewage flow averaged 2.5 mgd. Chlorine dosed at 8.3 ppm. 76 per cent of suspended solids removed, 73.3 per cent of B.O.D. removed. Corresponding projects carried out at plant site; 3,000 white and red pines were planted this year.

The report recommends increase in rates, raise in wages, improvements in both water and sewage plants to improve efficiency of operation of both.

Kenosha, Wisc. 1948 (mimeographed). H. T. Rudgal, Supt. of Water Dept. Daily consumption, 7.76 mgd. Industry used 46.4 per cent, residents 35.1, commercial accounts, 14.1, and 4.4 for public purposes. Income totaled $324,456.00, operating expenses, $203,119.00. Approximately 76 per cent of total operating expenses were for wages. Application made for rate increase. Accounted-for water amounted to 85.6 per cent, a reduction from a high of 94.5 five years ago. Decrease in accounted for water appears to

be related to the increase in industrial consumption.

The report includes complete tables and graphs on finances, operation, and maintenance of both water and sewage plants.

Annual Sewage Report prepared by Frank I. Vilen, Supt. Average flow 11.0 mgd., an increase of 108 per cent over the previous year. Gas produced, 48,100 cu. ft. per day. Solids removed, 10,000 lbs. per day. Average reduction in settleable solids, 95 per cent, and B.O.D., 52 per cent. Copper concentration in the digester sludge increased from .3 to .35 per cent.

Wabash River Pollution Limits Studied

Work has been started on a study of the 100-mile stretch of the Wabash River between Terre Haute, Ind., and Mt. Carmel, Ill. This work will provide the answer as to what steps must be taken to curb both municipal and industrial discharges in this interstate waterway.

The study of the Wabash River will be a cooperative interstate activity according to Joseph L. Quinn, Terre Haute, Ind., Chairman of the Commission. The work will be carried out under the direction of the Commission's staff and will pool the resources of the states of Indiana and Illinois, together with federal agencies and private industries.

Robert K. Horton, sanitary engineer of the Commission's staff, will be in charge of the survey operation. The state of Illinois will be represented by Clarence Klassen, state sanitary engineer, and the state of Indiana by Blucher Poole, technical secretary of the Indiana Stream Pollution Control Board. Both of these gentlemen are Commissioners of the Ohio River Compact Commission.

Announcement of this pollution study was made by E. J. Cleary, Exec. Dir. and Ch. Engr. of the Commission.

"No Bones About It"

In Albuquerque, New Mexico, some youngsters were doing a booming business selling human skulls and bones. The source was a mystery until it was discovered that the mechanized trenching machine, digging a sewer trench, had run through a long-lost-sight-of burying ground on the outskirts of town—likely an Indian or old prospector's burying ground.

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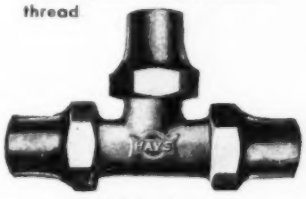

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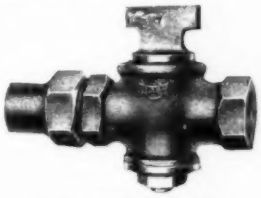

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Hays Curb Stop for iron pipe to copper service connection.

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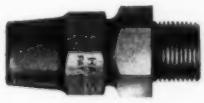
Hays Elbow for copper to copper connection.

CATALOG No. 5610
Hays Two Part Union for copper to copper connection.



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Northwestern Illinois Water Plant Operators' Conf.

The mid-year conference of the Northwestern Illinois Water Plant operators was held this year on July 27 at Nauvoo, Ill. The program consisted of a panel discussion on "Solving Water Problems" under the Moderator, W. K. Weeber, District Sanitary Engineer, Illinois State Health Dept., Galesburg. The problems discussed were "Taste and Odor" by Roy Metz, Supt. of Carthage; "Combined Upward-Flow Problems" by George Maharry, Supt. of Blandinsville; "Disinfection of Distribution Systems" by Frank Michael, Supt., Nauvoo; "Settling Basin Failure" by Wm. Newell, Supt. of Macomb; and "Iron Removal and Softening Problems" by Edward Bowen, Supt. of Stronghurst.

Also appearing on the program was C. W. Klassen, Chief Sanitary Engineer, Illinois State Department of Public Health, who spoke on "Nitrates and Other Unusual Substances in Water."

Lunch was served at the famous Hotel Nauvoo, and tours were made to historic spots such as the Blue Cheese Caves and the historic wine cellars.

Chairman of the conference is H. S. Merz, Supt. of Rockford, and Secretary is C. L. Baylor, Village Engineer, Downers Grove.

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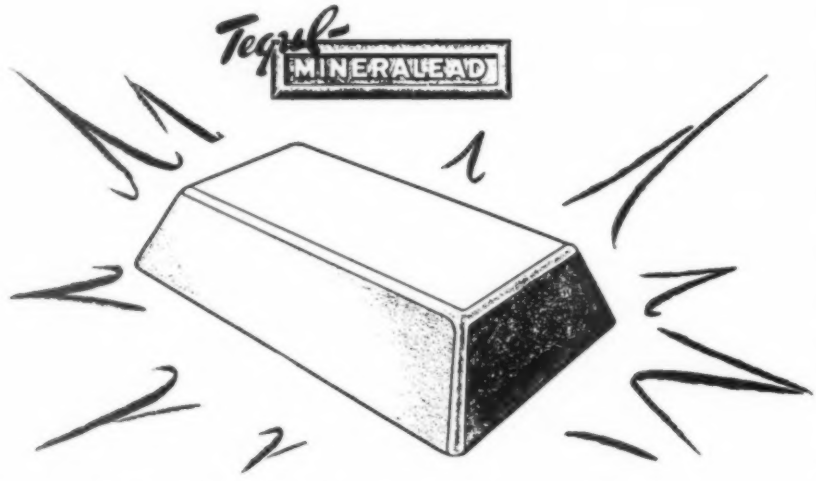

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Recent Books

Within the past year or so several books have been published on topics of interest to persons engaged in the field of water supply, sewage disposal, and industrial waste treatment.

No attempt is being made to review these books to any greater extent than to give information on what is contained therein, but herewith follows a short description of each, and how they may be obtained.

Public Health Law

"Public Health Law," by James A. Tobey, has been issued in its third edition, and has been expanded to include recent alterations in governmental organization and administration, and important legislative trends, as well as approximately 250 new court decisions. The book is divided into four parts: public health law and administration, powers and duties of health departments, liability and legislation, and law enforcement.

Public Health Law by James A. Tobey contains 440 pages, is published by the Commonwealth Fund, Division of Publications, 41 East 57th Street, New York 22, New York, and retails for $4.50 per copy.

Illinois Reservoir Hydrology

"Hydrology of Five Illinois Water Supply Reservoirs" is the title of Bulletin No. 38 of the Illinois State Water Survey Division. Compiled and edited by Wyndham J. Roberts, under the direction of A. M. Buswell, Chief of the Div., this bulletin was prepared in cooperation with the United States Geological Survey, Water Resources Branch.

The bulletin contains precipitation and runoff data, stream gaging data, and pumpage data for five water supply reservoirs in the State of Illinois, including Lake Bloomington, Carbondale reservoir, Lake Centralia, West Frankfort, and Lake Bracken. Except for an introduction, the entire book is devoted to graphs and tables of data.

The bulletin contains 259 pages and is printed by the State of Illi-

nois. Copies may be obtained by addressing requests to A. M. Buswell, Chief, Illinois State Water Survey Division, Urbana, Ill.

Caribbean Area Drainage

"DRAINAGE FOR HEALTH IN THE CARIBBEAN AREA" is the title of a book by E. H. Maggoon, Engineer in the Caribbean area, for the International Health Division of the Rockefeller Foundation. The book also carries a Spanish translation by Juan A. Hernandez, of the Ministry of Health of the Republic of Cuba.

The translation into Spanish is given in the left column of each page and the English version in the right hand column. The book is divided into three parts, the first discussing the Gulf States and Central America; the second, mosquito control, swamps, flood plains, seepage areas, surface water currents, mosquito breeding, ditching machinery, selection of concrete, surveying drainage outlets, sewerage, water supply, paving, organization of construction work, etc. Part Three contains illustrations and two appendixes. The book contains 556 pages and was published by the Salubridad Y Asistencia Social, La Habana Republica De Cuba.

Swimming Pool Operation

The Division of Sanitary Engineering of the Ill. State Health Dept. has revived its bulletin on "SWIMMING POOL OPERATION," published originally in July, 1946. The book was revised as of May, 1948. "SWIMMING POOL OPERATION" carries circular number 125 and was prepared under the direction of C. W. Klassen, Chief Sanitary Engineer and Jack G. Sieg, Senior Sanitary Engineer.

This excellent book is divided into four parts. Part I covers the operation objectives, pool variables, disease, safety legal responsibility, and personnel.

Part II is devoted to a discussion in the bathhouse.

Part III covers the subject of water treatment, dealing with such articles as water-treatment processes, hair and lint strainers, make-up water and cross connections, pumps and motors, disinfection, chlorination equipment, chlorine testing, bromination, coagulation, filtration, color inspection of pressure filters and water treatment calculations among others.

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Part IV is devoted to pool area covering such subjects as walk drainage, pool-bottom cleaning, algae control, swimmer capacity, sanitation, acoustics and so forth.

Part V discusses miscellaneous items such as operation reports, bacteriological analyses, off-season protection, pool classification, wading pools, bathing beaches and so forth. A number of photographs of actual installations complete the book.

For a copy of this book on "Swimming Pool Operation" write to C. W. Klassen, Chief Sanitary Engineer, Division of Sanitary Engineering, State Dept. of Health, Springfield, Ill.

Report on the Nation's Health

"THE NATION'S HEALTH—A TEN-YEAR PROGRAM" is the title of a report to the President by Oscar R. Ewing, Federal Security Administrator. This report, released in September, 1948, comments on the state of the nation's health and on plans to raise the national level of health during the next decade.

The report contains sections on the health of the nation's manpower, on hospitals, mental health, rehabilitation for the handicapped, community action, etc.

This 186-page book is for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at a price of $1.00 per copy.

Arkansas Water Supplies

"PUBLIC WATER SUPPLIES OF ARKANSAS" is the title of the University of Arkansas bulletin, Research Series No. 11, prepared by Harrison Hale, in cooperation with R. C. Baker, I. W. Walling, D. M. Parrish and G. A. Billingsley, of the U.S. Geological survey. This 104-page bulletin contains analysis of 178 water supplies, 132 of which are from wells, which supply 53 per cent of the total of population served; 35 supplies are obtained from surface water and serve 44 per cent of the population. Eleven supplies are obtained from springs.

Manometer Tables

The Instrument Society of America has published a book of tentative recommended practice for "MANOMETER TABLES." The book presents abbreviations and fundamental conversion factors commonly used in manometry, recommended definitions of pressure in terms of a column of mercury and water for a large number of liquids, tables of pressure indicated by, or equivalent to, heights of columns at various temperatures. These data in the tables presented have the object of facilitating and standardizing the use of manometers and U-tubes as direct pressure indicating instruments or in the calibration of pressure recorders and controllers.

This book may be obtained from the Instrument Society of America, Pittsburgh 12, Penna., for $2.00 per copy.

Water and Sewage Analysis Bibliography

As special report No. 28 of the Georgia Engineering Expt. Sta., a "BIBLIOGRAPHY ON WATER & SEWAGE ANALYSIS" has been prepared by B. H. Weil, Poagie E. Murray, George W. Reid, and Robert S. Ingols. The 215-page cloth-bound book was prepared under a grant-in-aid from the National Institute of Health of the U.S.P.H.S. It contains 2,560 entries devoted to chemical analyses, which are classified under 36 major headings and many minor headings referring to the substance sought. A cross-reference list gives constituent

(*Continued on page* 103A)

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WATER & SEWAGE WORKS

Will see that you receive information desired.

(*Continued from page* 102A)

analyses under type of procedure, as colorimetric, microscopic etc. Copies of this bibliography may be obtained for $4 each from the Director, Engr. Expt. Sta., Georgia Inst. of Technology, Atlanta, Ga.

Public Health in the World Today

The Harvard University Press, Cambridge 38, Mass., has published a series of lectures given at public health forums during 1947-48 at Harvard School of Public Health.

Most of the lectures contained therein are prepared by medical men, but one on "The Engineer in Public Health" was written by Dr. Abel Wolman, prof. of Sanitary Engineering, The Johns Hopkins School of Hygiene and Public Health, Baltimore.

This book, which will be of interest to most persons dealing with the problems of public health administration, may be obtained from the Harvard University Press, Cambridge 38, Mass., for $5.00 per copy.

Report of the Sanitary Commission of Massachusetts 1850

The American Public Health Assoc., 1790 Broadway, New York 19, N.Y., and the Harvard University Press have brought out a facsimile edition of the famous "Shattuck Report" made in 1850.

This report made fifty specific recommendations regarding sanitation, recording of vital statistics, protection of school children, medical research, nurses' training, slum clearance, and other problems vital to the

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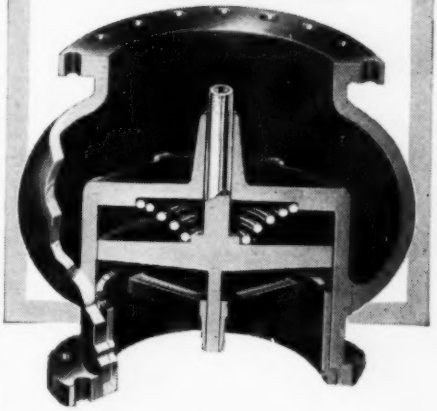

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increase of the mean expectation of life in the United States. Its first proposal was for the creation of state and local boards of health in an era when such state commissions were non-existent.

The book, by Lemuel Shattuck and others, is republished for the first time since its original release in 1850. Its release is sponsored by the A. P. H. A., Massachusetts Public Health Assoc., Harvard Graduate School of Public Health, Massachusetts Dept. of Public Health, and the Boston Health Department.

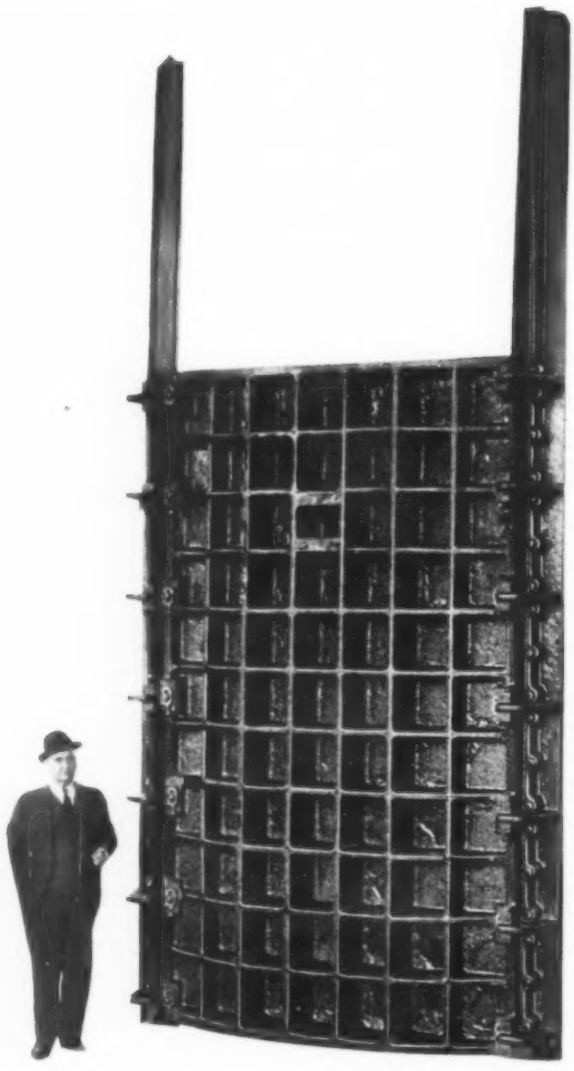
To obtain a copy of the Shattuck Report, address your request to the American Pub. Health Assoc., 1790 Broadway, New York 19, N.Y., and enclose check for $4.50.

Louisiana Short Course

The 12th Annual Short Course for superintendents and operators of water and sewage works was held in the Geology Building at Louisiana State University, June 29-30 and July 1. The Short Course was sponsored by Louisiana State University General Extension Division and College of Engineering, in cooperation with the State Health Department and the Louisiana Conference on Water Supply and Sewerage.

A program for certification of qualified personnel was carried on by the Conference jointly with the Short Course program. Application for certification is voluntary, but the increase in the number of certificates issued shows the great interest in and the value of this educational program.

The school was held under the directorship of John H. O'Neill, Director of the Division of Public Health Engineering, Louisiana State Department of Health.



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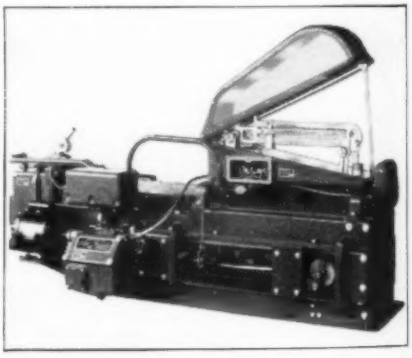
900 Chemical Dry Feeder

Wallace & Tiernan, Inc., Newark 1, N.J., has introduced a new chemical feeder to the water and sewage works field. Known as the Merchen Scale Feeder, this machine has been used in the flour, grain, and chemical industries for nine years.



The Merchen Feeder feeds continuously and accurately at any rate selected by the operator. It works by feeding by weight, using a constant speed belt drive with variable speed screw feed section, which eliminates the inherent inaccuracy of variable belt speed methods.

In the accompanying photograph is shown the Merchen Feeder with the side pannels removed to show internal construction. Motors are totally enclosed and the beam enclosure is dust tight. The machine is adaptable to any

program of proportional control, and alarm systems can be added. The machine will feed up to 2 cu. ft. per min. with high accuracy.

For further information about this new chemical feeder, use a Reader Service Card on which is entered the above key number and your name and address.

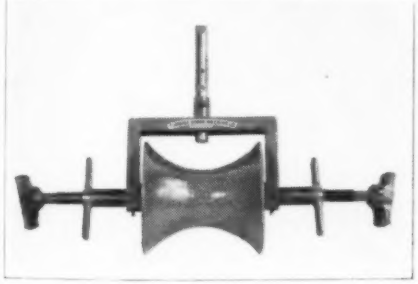
L. G. Thunfors V.P. and Gen. Mgr. Rensselaer Valve

The Rensselaer Valve Co., has announced that Lyman G. Thunfors has assumed the position of Vice President and General Manager of the company. Mr. Thunfors has had considerable foundry and factory experience at the Caterpillar Tractor Co. and the Richmond Radiator Co. Mr. Thunfors replaces E. A. Rutledge, who assumed the position of Vice President in charge of sales and sales engineering.

901

Sewer Cleaning Equipment

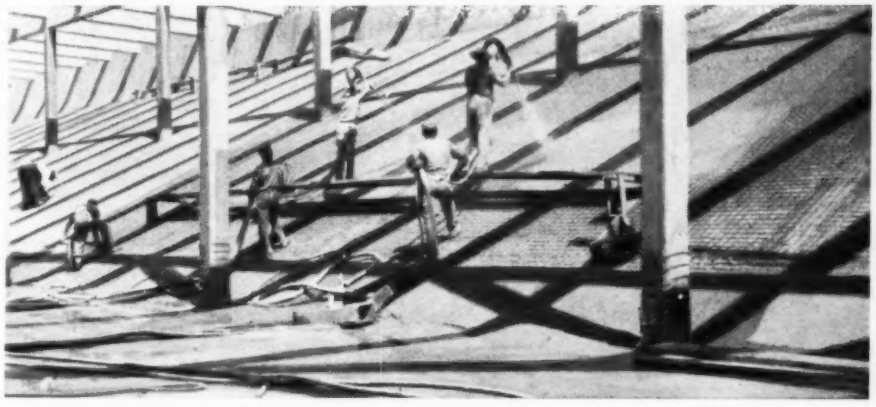
Turbine Sewer Machine Co., 5210 W. State St., Milwaukee, Wisc., is now marketing a redesigned type of "HG" Bucket Jack to enable a sewer cleaning bucket to travel to the street



surface for dumping. The jack is simple to adjust in the manhole and is built entirely of steel.

Also newly developed by the company is the cable guide for storm and sanitary sewer cleaning. Shown in the accompanying photograph this cable guide keeps the cable from binding on

"GUNITE" Selected to Repair Reservoir



When the old, open Ballou Park Reservoir at Danville, Va., was improved and covered in 1948, excessive leakage of the old brick lining was stopped with reinforced "GUNITE". The photo shows details of the process. After concrete columns to support the roof were placed, wire mesh reinforcing was laid and the entire reservoir was "GUNITED". Note that the reinforcing and "GUNITE" were carried over the column footings and up the columns approximately three feet to prevent leaking at those points.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin C2400. We will gladly send a copy at your request. On your letterhead, please.

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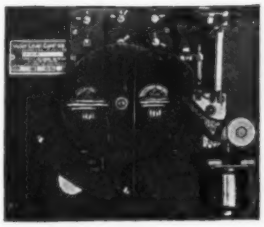


ROTO-TROL

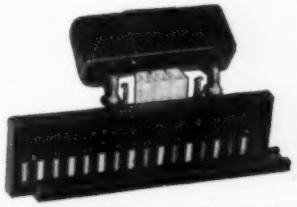
PRESSURE operated. Controls high and low elevation of water line in an elevated tank, standpipe, or reservoir—within small and exact limits. Located usually in the pump house. Pressure connection is taken from the pump discharge line. Sudden changes in pressure due to surges are automatically compensated. The time delay protects from backspin.

Furnished in both single and multi-pump combinations.

WRITE FOR ENGINEERING DATA

WATER LEVEL CONTROLS DIVISION OF
HEALY-RUFF COMPANY
783 HAMPDEN AVE., ST. PAUL 4, MINN.

Chlorine DETERMINATIONS
—easy for everyone with



TAYLOR-ENSLOW SLIDE CHLORIMETER

. . . No special training necessary. The accuracy, compactness, durability and portability of the Taylor-Enslow Slide chlorimeter makes it ideally suited to on-the-spot determinations of the free or residual chlorine content of water, sewage and industrial wastes.

Taylor-Enslow slides are molded of plastic . . . contain a complete set of 9 liquid color standards, all of which carry an unlimited guarantee against fading. Two slides are available: 0.0 to 1.0 p.p.m. and 0.0 to 3.0 p.p.m. of chlorine. Combination pH and Chlorine sets, and complete Taylor Water Analyzers are also available.

READ THIS VALUABLE BOOK—FREE

96 pages of authoritative general information for water and sewage engineers as well as describing Taylor sets. Write for your copy today—see your dealer for equipment.

W. A. TAYLOR AND CO.
7308 YORK RD. • BALTIMORE 4, MD.

the sewer tile and permits the sheave wheel to be adjusted to compensate for sewers which are located above the floor of the manhole.

To obtain further information on these units, use a Reader Service Card on which is entered the above key number and your name and address.

902

Silent Check Valve

The Williams Gauge Co., 1620 Pennsylvania Ave., Pittsburgh 12, Pa., has available a Williams-Hager flanged Silent Check Valve.

This unit has been used for more than seventeen years, and should have a wide application in the water and sewage works industry. The unit can be used in any position, gives real pump protection, is silent in operation and is insurance against damaging water hammer. The unit is built of material that meets requirements of any service and for all pressures.

To obtain further information on the Williams-Hager Silent Check Valve use a Reader Service Card on which is entered the above key number and your name and address.

C. H. Morse III of Fairbanks-Morse Killed

Charles Hosmer Morse III, Vice President in Charge of Manufacturing, of Fairbanks, Morse & Co., and eldest son of Colonel Robert H.

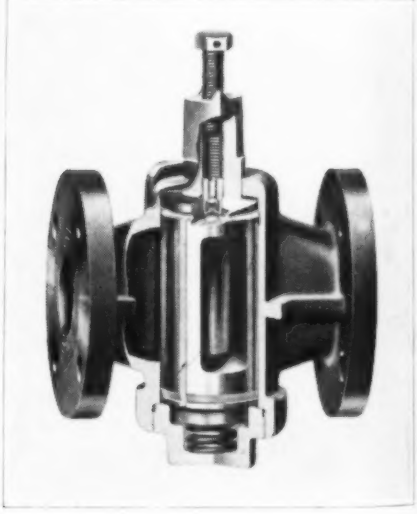
Morse, President of the company, lost his life when the company's Lockheed Lodestar plane crashed near Roanoke, Ill., in July.

Mr. Morse has been connected with the company since 1919, and has been Vice President in Charge of Manufacturing since 1946.

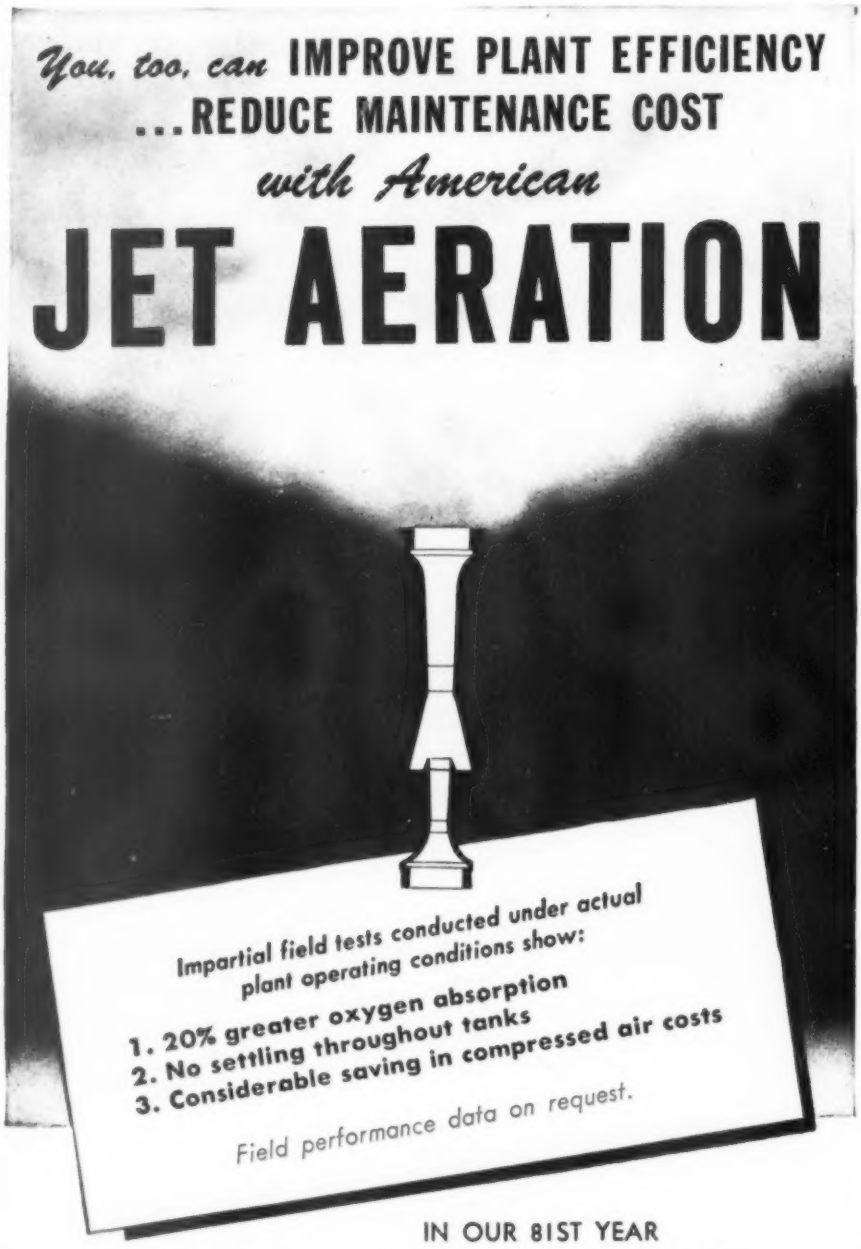
903

Plug Valve

Homestead Valve Mfg. Co., Coraopolis, Penna., has announced the introduction of a new lubricated plug valve which automatically compensates for wear. Known as the Homestead-Reiser Self-Seald Valve, the new plug valve has a cylindrical plug with a wedge action which not only



adjusts itself for wear, but also keeps the sealing surfaces of the plug and body in intimate contact to provide an extra tight seal against leakage and lower lubricant losses. Among other features are port areas equal to the area of standard pipe, complete lubricant seal around the ports, and posi-


You, too, can IMPROVE PLANT EFFICIENCY
...REDUCE MAINTENANCE COST
with American
JET AERATION
Impartial field tests conducted under actual plant operating conditions show:
1. 20% greater oxygen absorption
2. No settling throughout tanks
3. Considerable saving in compressed air costs
Field performance data on request.

IN OUR 81ST YEAR

AMERICAN WELL WORKS

108 North Broadway
AURORA, ILLINOIS

Pumping, Sewage Treatment, and Water Purification Equipment
RESEARCH · ENGINEERING · MANUFACTURING

Offices: Chicago · New York · Cleveland · Cincinnati · Kansas City · Sales Representatives throughout the World

Our staff of Sanitary Engineers will cooperate with consulting and operating engineers in suggesting the process of treatment and type of equipment best suited to individual needs.

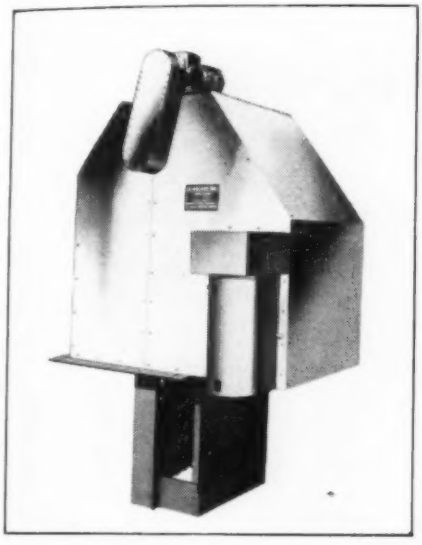
tive visible stops to limit operation to a quarter-turn.

To obtain further information on this new plug valve, use a Reader Service Card on which is entered the above key number and your name and address.

904

Mechanically Cleaned Screen

American Well Works, Aurora, Ill., has announced a completely new design in a mechanically cleaned bar screen with grinder for sewage works. This new Unit Screen is fully automatic and is adaptable for minimum channel widths and settings or parallel multiple installations for large flows.



Among the features included are completely automatic electrical control, shear pin protection for overloads, rake teeth which enter the bottom of the screen bars horizontally and positive releasing of screenings into sorting trays.

To obtain further information on this new unit use a Reader Service Card on which is entered the above key number and your name and address.

Allen L. Spafford Represents Hooker

Hooker Electrochemical Co. has announced the appointment of Allen L. Spafford as field salesman in the territory comprising upper New York State and western Pennsylvania. Mr. Spafford has been associated with the company for two years as a process study engineer.

His headquarters will be in the Niagara Falls office.

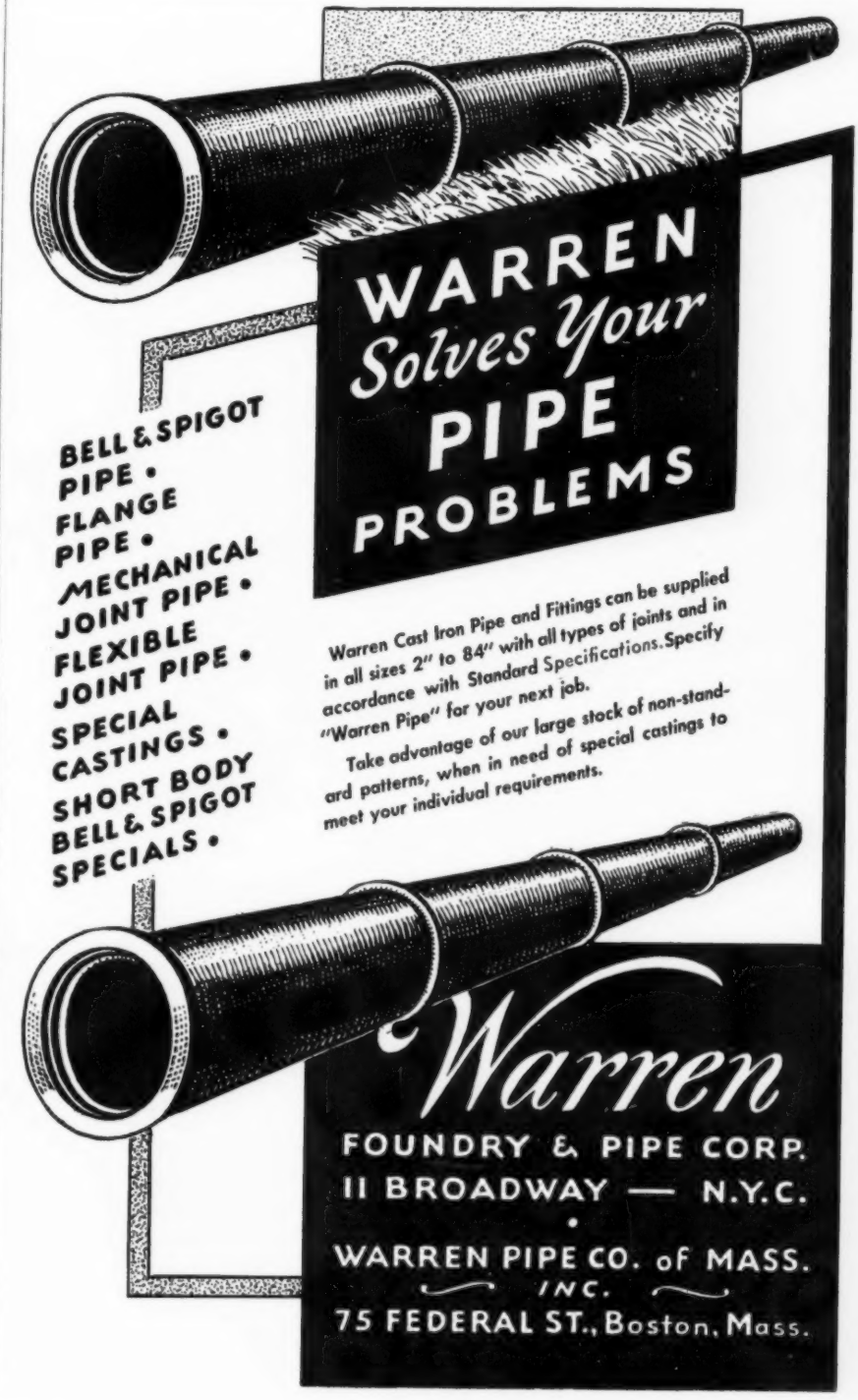
Electro-Chemical Supply and Engr. Co. Reorganizes

C. R. Payne

The Electro-Chemical Supply and Engineering Co., Paoli, Pa., has announced complete reorganization. This is the first company in the United States to make a sulfur base jointing material plasticised with "Thiokol."

The new officers are Dr. C. R. Payne, President; J. Wm. Grant, Vice Pres. and Sales Mgr; Wm. A. Sesher, Treasurer and Production Mgr; Walter L. Sheppard, Jr., Adv. Mgr. and Export Sales Mgr.

The Electro-Chemical Supply and Engineering Co., founded in 1912, has offices in the Wedge Bldg., Paoli, Pa., and manufacturing facilities at Emmaus (Allentown) Pa., which went into full production in July.


WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE • FLANGE PIPE • MECHANICAL JOINT PIPE • FLEXIBLE JOINT PIPE • SPECIAL CASTINGS • SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
11 BROADWAY — N.Y.C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

Appointments at Atlas Mineral Products

Within recent weeks, the Atlas Mineral Products Co. of Mertztown, Penna., has announced several appointments to the company's operating staff. Arthur F. Wirtz, Jr., and George L. Wirtz, Jr., grandsons of the late M. F. Wirtz, founder of the firm, have joined the company and been assigned to supervision and sales departments respectively.

Edison Sickman has been appointed District Sales Manager of the Middle Atlantic territory, and George P. Gabriel has been appointed as an engineer in the factory.

Johnston Pump Co. Personnel Changes

T. W. Simmons, Jr.

K. G. Lundie

The Johnston Pump Co. of Los Angeles, California, has announced changes in personnel. T. W. Simmons, Jr. has been elected Vice-President and General Manager of the Company, and Kenneth G. Lundie has been appointed General Sales Manager.

905

Motor Operator for Valves

Crane Co., Chicago, Ill., has announced a simplified fluid-motor operator for gate valves. The new design makes possible the extensive use of motor operated valves, since the actuating unit can be easily adapted to standard valves in stock or to valves already installed. The device can be operated by water, oil, or compressed air or gases. The unit is shown in the accompanying photograph.

To obtain further information on this valve operator, use a Reader Service Card, on which is entered the above key number and your name and address.

Marsteller and Melius Named Rockwell Vice Presidents

Rockwell Manufacturing Co. has announced the election of William A. Marsteller of Chicago, and Robert P. Melius of Milwaukee, as Vice Presidents of the Rockwell Manufacturing Co.

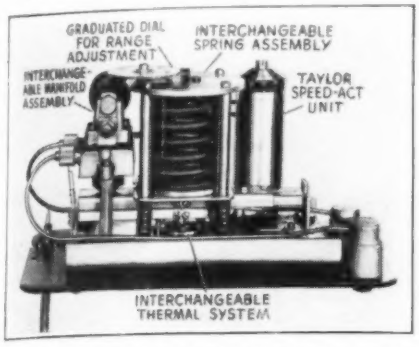
Mr. Melius is in charge of sales for the newly-created Power Tool Division and Mr. Marsteller is the Manager of the Advertising and Market Research Department for the company.

LABOR COSTS IN OUR METER SHOP ARE 'WAY DOWN SINCE WE HAVE PRACTICALLY ALL BUFFALO METERS IN THE SYSTEM
The extreme simplicity of Buffalo Meters reduces the need for repairs. When servicing is finally necessary, less time is required. Assembly is unsurpassed for simplicity and parts are inter-changeable.
AMERICAN BRONZE CASE
NIAGARA GALV IRON CASE
WATER METERS
BUFFALO METER COMPANY
2909 MAIN STREET, BUFFALO 14, N. Y.

906

Temperature Transmitter

Taylor Instrument Co., Rochester 1, N.Y., has announced the development of a new force-balance type pneumatic temperature transmitter called the "Transaire" with "Speed-Act." This new instrument is designed particularly for those applica-



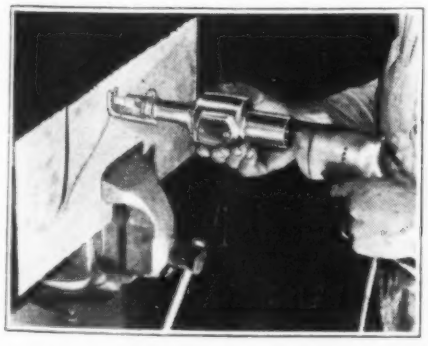
tions where it is desirable to have the indication, record or control remotely located from the point of measurement and where it is necessary to have accuracy, high speed of response, small thermal elements and short range spans within the limits of minus 375 and plus 1000 deg. F. "Speed-Act" overcomes the lag inherently present in the response of any form of thermal measuring element.

For further information on this new device, use a Reader Service Card on which is entered the above key number and your name and address.

907

Portable Power Hack Saw

Producers and Distributors, Inc., 4015 Macarthur Blvd., Oakland 19, Calif., has designed and developed a new type of portable power saw and file attachment. Known as the "Key-Hak" this unit will do any of the work of the tools from which it derives its composite trade name, the



key-hole saw, and the hack saw. This unit is attached to any electric or air drill for operation.

To obtain further information, use a Reader Service Card, on which is entered the above key number and your name and address.

908

Hydro-Pneumatic Tank Calculator

Automatic Control Co. of St. Paul, Minn., has developed and is making available an "Autocon Tank Calculator." Eliminating all old "rule of thumb" methods, this Calculator (based on Boyles Law) instantly tells the best air-water ratio, the most efficient pressure drop, and the resultant reserve or residual.

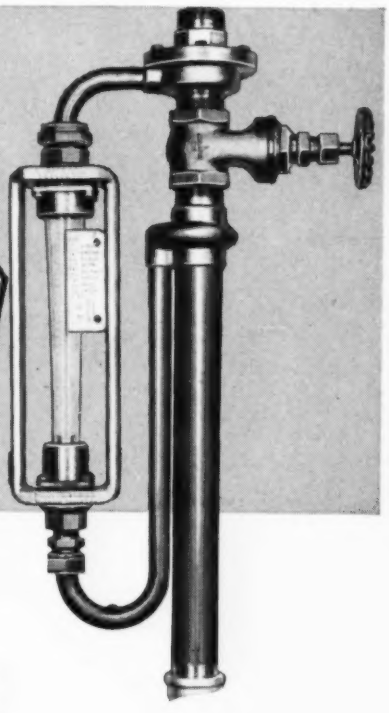
This information can save power and reduce maintenance costs by anticipating the pump operations per hour at any demand rate, thus speedily determining what air-water ratio, pressure and differential will provide most efficient operation.

All computing scales are on one side of the calculator and are included for convenience. Convenient in size, 9 by 4 in., the Calculator retails for $1.00 post paid. For further information write directly to Automatic Control Co., 1005 University Ave., St. Paul 4, Minn.

Koppers Pres. Elected to Board of Carborundum

Announcement has been made that General Brehon Somervell, Pres. of Koppers Co. Inc., was elected a member of the Board of Directors of the Carborundum Co.

New FORD Testerate Indicator has wide range



Now, for the first time you may measure both small and large test flows on the same indicator, and with close accuracy.

The new Ford Double Range Testerate Indicator checks the flow of a test stream at a glance, down to as low as ¼ g.p.m. and up as high as 175 g.p.m.

Operation is easy. On flows over 35 g.p.m., merely open by-pass valve wide and take reading on high range scale.

The Double Range Testerate Indicator is adequate for all sizes of meters up to 2" and even larger.

Send for complete information and new catalog.

The TESTERATE INDICATOR

FOR BETTER WATER SERVICES

FORD

Manufactured by THE FORD METER BOX COMPANY, INC.

Wabash, Indiana

Ed Cantrell of Neptune Meter Dies

Edwin L. Cantrell of Louisville, Ky., died suddenly in July at the age of fifty-seven. Mr. Cantrell had held the position of Louisville District Manager of the Neptune Meter Co. since 1921 and had been associated with the company since 1913. Mr. Cantrell was active in the Ky.-Tenn. Sect. of the American Water Works Assn.

909

Wedgetite Sulfur Jointing Material

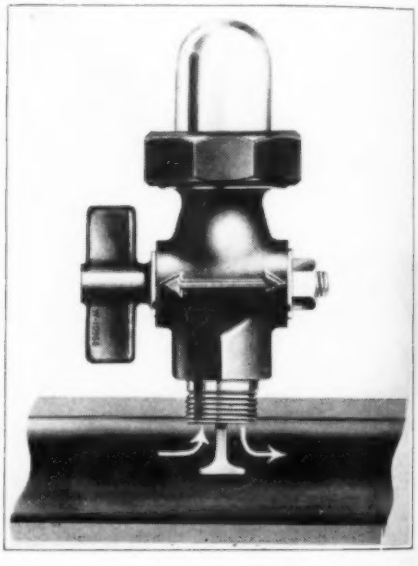
The Electro-Chemical Supply and Engineering Co., Paoli, Penna., has announced a plasticized sulfur base pipe jointing material in a new and convenient form known as "Wedgetite". "Wedgetite" is plasticized with "Thiokol" under license from the Texas Gulf Sulfur Co. It is produced in the form of small thin wafers easily melted in the common type of melting pot.

It is claimed that "Wedgetite" is not affected by sulfur oxidizing bacteria due to the addition of a germicide in the formula.

910

Sight Glass With Valve

The Worthington Pump & Machinery Corp., Harrison, N. J., has developed a new Sight Glass with Valve. By means of this valve type sight glass, the clarity or turbity of transparent liquids flowing under pressure in pipe lines can be easily observed.



The operation depends upon a differential pressure established across a deflector, to allow some of the liquid to circulate continuously through the glass observation bowl. A special feature is provided by the valve which permits the removal of the observation bowl for cleaning.

To obtain further information on this unit, use a Reader Service Card on which is entered the above key number and your name and address.

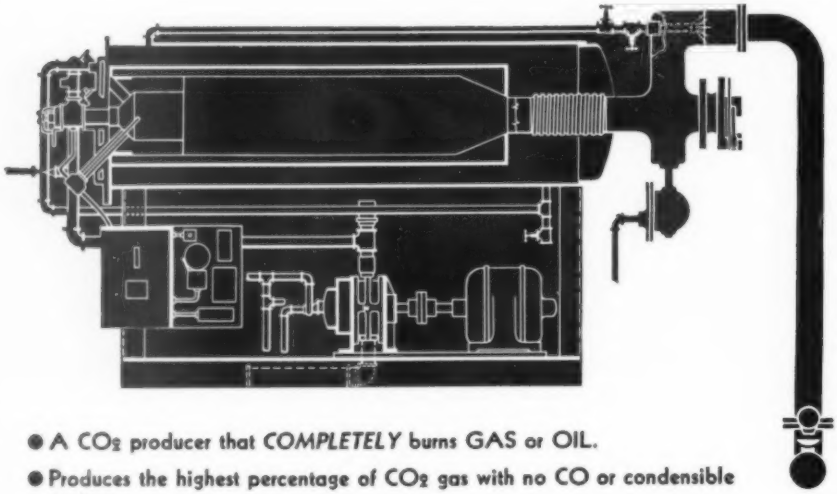
Wm. Hopwood Vice Pres. Calgon

Announcement has been made of the election of William W. Hopwood as Vice President of the Hagan Corp., Pittsburgh, Pa., and its subsidiaries, Calgon, Hall Laboratories,

CARBALL CO_{TWO} UNIT...

SPECIFICALLY DESIGNED FOR THE CLEAN, EFFICIENT CARBONATION OF LIQUIDS

93% ABSORPTION — 88% TOTAL CHEMICAL EFFICIENCY



- A CO_2 producer that *COMPLETELY* burns GAS or OIL.
- Produces the highest percentage of CO_2 gas with no CO or condensible carbon.
- Completely eliminates oil scum . . . no taste imparted to potable waters.
- No scrubbers or filters required.
- Compressor handles clean, cold air only. The fuel is burned under sufficient pressure to cause deep diffusion directly from the producer.
- Diffuses CO_2 gas by efficient impingement diffuser, insuring 93% absorption and eliminating diffuser corrosion.
- A factory-tested, package unit with air compressor, fuel pumps and appurtenances mounted on one frame.
- 50% more chemical efficiency than any other method in current practice.

To Reduce Costs and Modernize Your Plant:

WRITE FOR BULLETIN 757

WALKER PROCESS EQUIPMENT INC.

FACTORY • ENGINEERING OFFICES • LABORATORIES

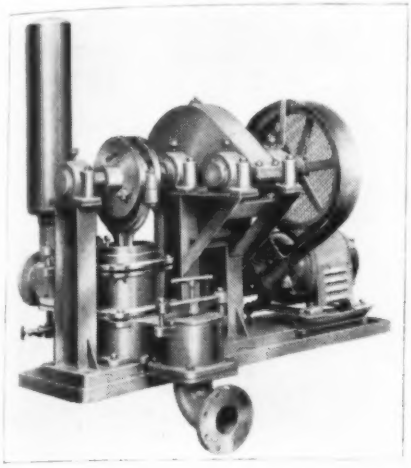
518 HANKES AVENUE • AURORA, ILLINOIS

PROQUIP

and the Buromin Co. Mr. Hopwood has been associated with the corporation for a number of years before the war, and returned there after serving in the Army Air Corps.

911

Diaphragm and Plunger Pumps



Marlow Pumps, Ridgewood, N.J., has announced a newly expanded line of diaphragm and plunger pumps. Included in the new line are motor- and engine-driven diaphragm and walking-beam plunger pumps and eccentric drive plunger pumps. There are thirty basic models, sizes and types included in this group. From these basic models the range can be broadened practically without limit by variations and combinations.

Some of the applications for sludge pumps are the removal of sludge from settling tank hoppers and transfer of materials from digestion tanks to storage units and sludge beds. The pumps will not air-bind or gas-bind, and will operate efficiently on suction lifts as high as 20 feet. They are effective in passing large quantities of bulky debris. Capacities range over a wide area.

To obtain further information on these pumps use a Reader Service Card on which is entered the above key number and your name and address.

912

Laboratory Water Still

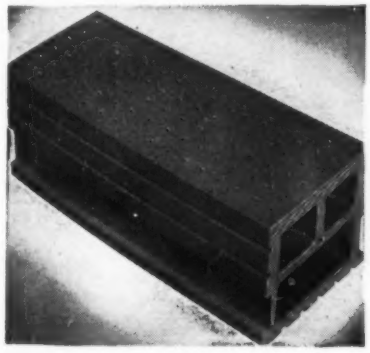
Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill., has announced a new "Streamliner" model laboratory water still. The new still is of polished stainless steel, in three offset sections with vaportight sliding joints. The new still incorporates

an exclusive built-in after cooler, and a design which insures that volatile gases are completely liberated. The sections can be taken apart in ten seconds for ease of cleaning. Electric, gas, and steam heated models are available.

To obtain further information on this new still, use a Reader Service Card on which is entered the above key number and your name and address.

Leopold

GLAZED FIRE CLAY TILE FILTER BOTTOM



• Permanent • Non-corrosive • Economical • Impervious to acid or alkali solutions • Practically non-absorbent • Equal distribution.

Complete water purification and sewage plant equipment.
Write today for complete information

F. B. LEOPOLD CO., INC.
2413 W. CARSON ST. PITTSBURGH 4, PA.

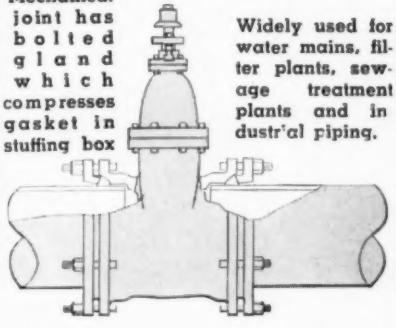
M H

Mechanical-Joint

HYDRANTS & VALVES

In addition to bell-and-spigot and flanged, we now offer M & H Valves and Hydrants with mechanical-joints for use with standardized mechanical-joint Cast Iron Pipe.

Mechanical joint has bolted gland which compresses gasket in stuffing box



Widely used for water mains, filter plants, sewage treatment plants and in dustr'al piping.

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	MUD VALVES
GATE VALVES	VALVE BOXES
TAPPING VALVES	FLAP VALVES
WALL CASTINGS	SLUDGE SHOES
SPECIAL CASTINGS	FLANGE AND
TAPPING SLEEVES	FLARE FITTINGS
CHECK VALVES	FLANGED
FLOOR STANDS	FITTINGS
EXTENSION STEMS	B & S FITTINGS
SHEAR GATES	CUTTING-IN TEES

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

LITERATURE AND CATALOGS

913

REINFORCED CONCRETE PIPE

The Lock Joint Pipe Co., East Orange, New Jersey, has available a folder including a complete set of catalogs on **Lock Joint Reinforced Concrete Pipe.** This folder includes bulletins listing the various installations of the pipe, subaqueous installations, cylinder pipe, pipe specials and articles showing installations at various locations.

To obtain a copy of this informative folder on Reinforced Concrete Pipe, use a Reader Service Card on which is entered the above key number and your name and address.

914

GLOBE AND ANGLE VALVES

Kennedy Valve Mfg. Co., Elmira, N.Y., has issued a new folder describing the **Kennedy Bronze Globe and Angle Valves** with Renewable Composition Discs.

The folder is illustrated with photographs of all of the important construction features of this line of Valves, recommended for services up to 150-lb. Steam or 300-lb. Cold Water, Oil, or Gas. A blow-up of a sectional drawing is also included to explain the complete valve, as well as a table of available sizes and dimensions.

To obtain a copy of this circular, use a Reader Service Card on which is entered the above key number and your name and address.

915

WATER WORKS VALVES

In a 4-page folder the Darling Valve & Manufacturing Co. of Williamsport, Pa., presents its **Darling Water Works Valves.** Pictured in the folder are a number of typical installations where Darling Valves are used. Also shown is a cutaway drawing of the design and construction of the valve.

To obtain a copy of this folder use a Reader Service Card on which is entered the above key number and your name and address.

916

TRENCHER

Construction Products Corp., 410 San Fernando Road, Los Angeles 31, California, has issued a bulletin on the **Profit-System Trencher.** This Profit Trencher which is mounted on a Case tractor, has a wide range of applications. The bulletin shows many of these applications for making trenchers for sewage pipe and water pipe lines and other uses. The "Profit Trencher" has eight forward "creep" speeds, two wheel speeds, to provide sixteen forward digging combinations and in addition has the advantage of doing its own backfilling and loading on trucks.

To obtain a copy of this bulletin use a Reader Service Card on which is entered the above key number and your name and address.

917

PORTABLE CENTRIFUGAL PUMP

Deming Co., Salem, Ohio, has issued a one-page sheet describing the **Deming Portable Self-Priming Centrifugal Pumps.** This unit weighing about 83 lb. employs a 1½ hp. engine and has a maximum capacity of 5400 gph.

FIRST OF A SERIES COVERING

The Facts About Activated Alum

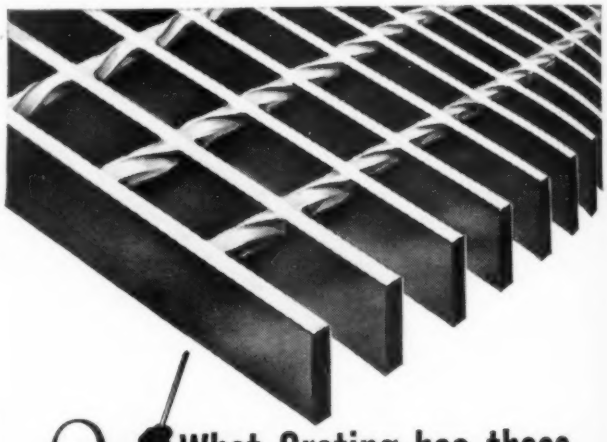
*Eliminates need for using any coagulant aid because it contains silicates.

*The silicates provide a nucleus for floc formation at no extra cost.

*Available in A. W. W. A. fineness of grind or in dust-free rice size.

*Priced to compete with other filter alums.

Activated Alum Sales Corp.
516 North Charles Street
Baltimore 1, Maryland



What Grating has these 5 important features?

1. One-piece electroforged construction develops the full strength of all sections.
2. Maximum Open Area for light and ventilation.
3. Easy to maintain . . . easy to paint thoroughly.
4. Self-Cleaning, no sharp angles to retain debris.
5. Safe footing at all times due to twisted cross bar.

BLAW-KNOX GRATING

BLAW-KNOX DIVISION OF BLAW-KNOX CO., 2051 FARMERS BANK BLDG., PITTSBURGH 22, PA.

To obtain a copy of this sheet, use a Reader Service Card on which is entered the above key number and your name and address.

918

AUTOMATIC CONTROL EQUIPMENT

The Automatic Control Co., 1005 University Ave., St. Paul 4, Minn., has issued a combined **General Catalog for Water Works and Sewage Disposal.** This catalog shows the design and construction of every possible type of control equipment used in water and sewage works, including such items as those known as the "Tanktrol," "Protectrol," pressure tank controls, float operated controls, sequence controls, float switches, other pump controls and other equipment.

To obtain a copy of this General Catalog use the Reader Service Card on which is entered the above key number and your name and address.

919

CLOW PRODUCTS

James B. Clow & Son, 201 N. Talman Ave., Chicago 12, Ill., has issued a folder showing the Clow Standardized Bottle-Tight **Mechanical Joint** for cast iron pipe. The folder shows how the pipe is laid and the joint installed and made tight. It is a flexible joint.

To obtain a copy of this folder, use a Reader Service Card on which is entered the above key number and your name and address.

What Reader of

Water and Sewage Works Magazine

Needs A Man

with background of engineering training and seventeen years of experience in this sanitary field including Development and Invention, Sales, Advertising, Promotion, Production, Management and all phases of a business providing mechanical equipment for water and sewage treatment?

This man had only eight positions in twenty-seven years, his longest uninterrupted employment being eleven years with a firm of water works equipment manufacturers, of which he was founder, president, and served in many capacities in development, correspondence, sales, design and production; both out in the field and in home office executive capacities.

Previously to this long term and immediately after receiving BS in ME (Illinois Institute of Technology), his other six jobs in ten years included employment with boiler and stoker manufacturers, one technical publication, an equipment manufacturer in oil-refining field, and employment by a consulting and management engineering firm.

Seventeen years have been exclusively in the water and sewage works field with major effort on national sales promotion of technical equipment. The widely generalized business experience was about equally divided between eastern and midwest headquarters and included wide travel in U.S., Canada, and Mexico, and included work with municipalities, industry, and government.

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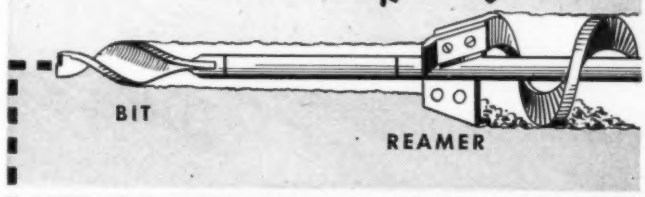

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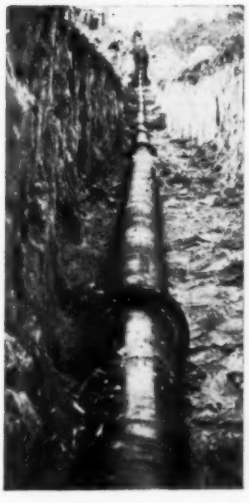

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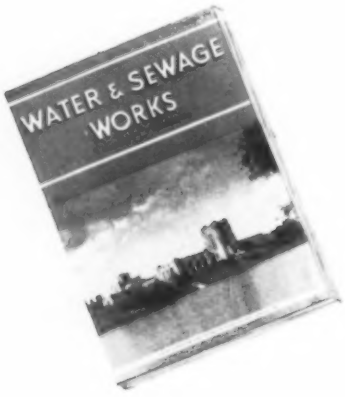

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920

LIMITORQUE CONTROL

Philadelphia Gear Works Inc., Erie Ave. & G St., Philadelphia 34, Pa., has issued a complete bulletin on **Limitorque Valve Control.** This catalog contains pictures and descriptions of all of the various types of limitorque valve control manufactured and the uses to which they are put. Dimensions are shown, description of equipment given, methods of operation, controlling devices and other pertinent information.

To obtain a copy of this complete catalog, use a Reader Service Card on which is entered the above key number and your name and address.

921

CENTRIFUGAL PUMPS AND ACCESSORIES

Barrett, Haentjens & Co. of Hazelton, Pa., have available a consolidated catalog of **Centrifugal Pumps and Accessories.** This includes double suction, single stage pumps, standard multi-stage volute pumps, pumps with balancing discs, special sludge pumps, self-priming pumps, and portable pumps and electrodes. Many of these pumps are designed for dewatering work in mines but will find equal application in water and sewage works. These pumps are known as the Hazleton Pumps.

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922

FLOC PRODUCER

Alhydro, Inc., 516 North Charles St., Baltimore 1, Md., has just released a new four-page folder describing the **Alhydro Floc Producer.** The bulletin describes how the Floc Producer works, and shows cut-away drawings of the unit and its construction. Information is also given on the application of the unit to the coagulation of water, and the advantages accruing therefrom.

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923

"TRANSITE" PRESSURE PIPE

The Johns-Manville Co., 22 E. 40th Street, New York 16, N.Y., has published a bulletin entitled **Engineering Facts about "Transite" Pressure Pipe.** This 12-page bulletin presents informative data about asbestos-cement pipe and the advantages of the use of this material for its high carrying capacity, tight, flexible joints, long life expectancy, and other features. The book contains photographs and text giving documented answers to questions concerning the various features mentioned.

To obtain a copy of this bulletin on "Transite" Pipe, use a Reader Service Card on which is entered the above key number and your name and address.

924

PRESSURE SEAL PLUG

Smith Blair, Inc., 535 Railroad Ave., South San Francisco, Calif., has issued a 4-page bulletin on its new **Pressure Seal Plug.** This bulletin shows cutaway drawings of how the plug is constructed, how it is installed, and why the greater the pressure the tighter the seal. The unit may be obtained to fit any pipe from 3¾ in. through 10-in. inside diameter. The bulletin lists nine advantages of this pressure seal plug and gives sizes and prices.

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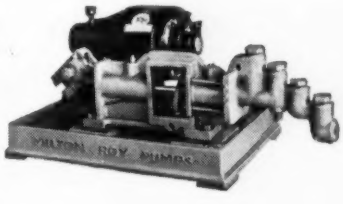

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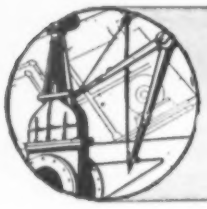

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INDEX TO ADVERTISERS

A

Activated Alum Corp. 112A
Allied Chemical & Dye Corp. 35A
American Brass Company, The 16A
American Well Wks. 106A
*Anthracite Equipment Co. 101A
Atlas Mineral Products Co. 100A

B

Baker Adamson Products, General Chemical Div., Allied Chemical & Dye Corp. 35A
Barrett Haentjens & Co. 101A
Blaw-Knox Co. 112A
Buffalo Meter Co. 108A
*Builders Iron Foundry 13A-34A
*Builders-Providence, Inc. 13A-34A
Byers Co., A. M. 6A

C

Carborundum Co. 11A
Carson Cadillac 101A
Cast Iron Pipe Research Ass'n. ... 10A-11A
Cement Gun Co. 105A
Central Foundry Co. 27A
Centriline Corp. 39A
Chain Belt Co. 18A
Chapman Valve Mfg. Co. ... Second Cover
Chicago Bridge & Iron Co. 17A
*Chicago Pump Company 83A
Clow & Sons, Jas. B. 85A
Crane Co. 31A

D

Darley & Co., W. S. 99A
Darling Valve & Mfg. Co. 26A
De Laval Steam Turbine Co. 22A
Diamond Alkali Co. 25A
Directory of Engineers ... 116A-117A-118A
Dixie Tank & Bridge Co. 97A
Dorr Co. ..... Inside Back Cover
Dresser Mfg. Division 24A

F

Fairbanks-Morse 23A
Filer & Stowell 104A
*Flexible Sewer-Rod Equipment Co. 96A
*Flexible Underground Pipe-Cleaning Co. 96A
Ford Meter Box Co. 109A
Foxboro Co., The 95A

G

General Chemical Div. (Allied Chemical & Dye Corp.) 35A
General Electric Co. 8A-9A
Goldak Co. 118A
*Golden-Anderson Valve Specialty Co. 89A

H

Hays Mfg. Co. 99A
*Healy-Ruff Co. 105A
*Hellige, Inc. 103A
Hydrauger Corp. 113A
Hydraulic Development Corp. 37A

I

Industrial Chemical Sales 21A
Inertol Co. 95A
*Infilco, Incorporated 20A
Iowa Valve Co. 85A

J

*Jeffrey Mfg. Co. 19A
Jones, John Wiley 89A

L

Layne & Bowler 28A
Leadite Company 103A
*Leopold Co., F. B. 111A
*Link-Belt Co. 29A

M

*M. & H. Valve & Fitting Co. 111A
Mathieson Chemical Corp. 4A
McWane Cast Iron Pipe Co. 113A
Mueller Co. 40A

N

Neptune Meter Company 42A
Nichols Engineering & Research Corp. 38A
Northrop & Co., Inc. 86A

O

*Omega Machine Co. 98A

P

Pacific Flush Tank Company 30A
Peerless Pump Div. 90A
*Permutit Co. 32A
Phipps & Bird Inc. 86A
*Pittsburgh-Des Moines Steel Co. .. 15A
Pittsburgh Equitable Meter Co. 3A
Pittsburgh Pipe Cleaner Co. 102A
*Proportioneers, Inc. 33A

R

Ridge Tool Co. 94A
Roberts Filter Mfg. Co. 91A
Rockwell Mfg. Co. 3A
Roots-Connersville Blower Corp. .. 84A
Roy C. Milton 115A

S

Simplex Valve & Meter Co. 14A
Smith Mfg. Co., A. P. 87A
Solvay Sales Div. 88A
Sonken-Galamba Corp. 103A
Sparling, R. W. 86A
Standard Stoker Corp., Inc. 36A
*Stuart Corp. 115A

T

Taylor Co., W. A. 105A
Tennessee Corp. 97A

U

*U. S. Pipe & Fdry. Co. 7A

W

Walker Process Equip., Inc. 110A
*Wallace & Tiernan Co., Inc. .. Back Cover
Warren Foundry & Pipe Corp. 107A
Westinghouse Electric Corp. 92A-93A
Williams Gauge Co., The 103A
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Z

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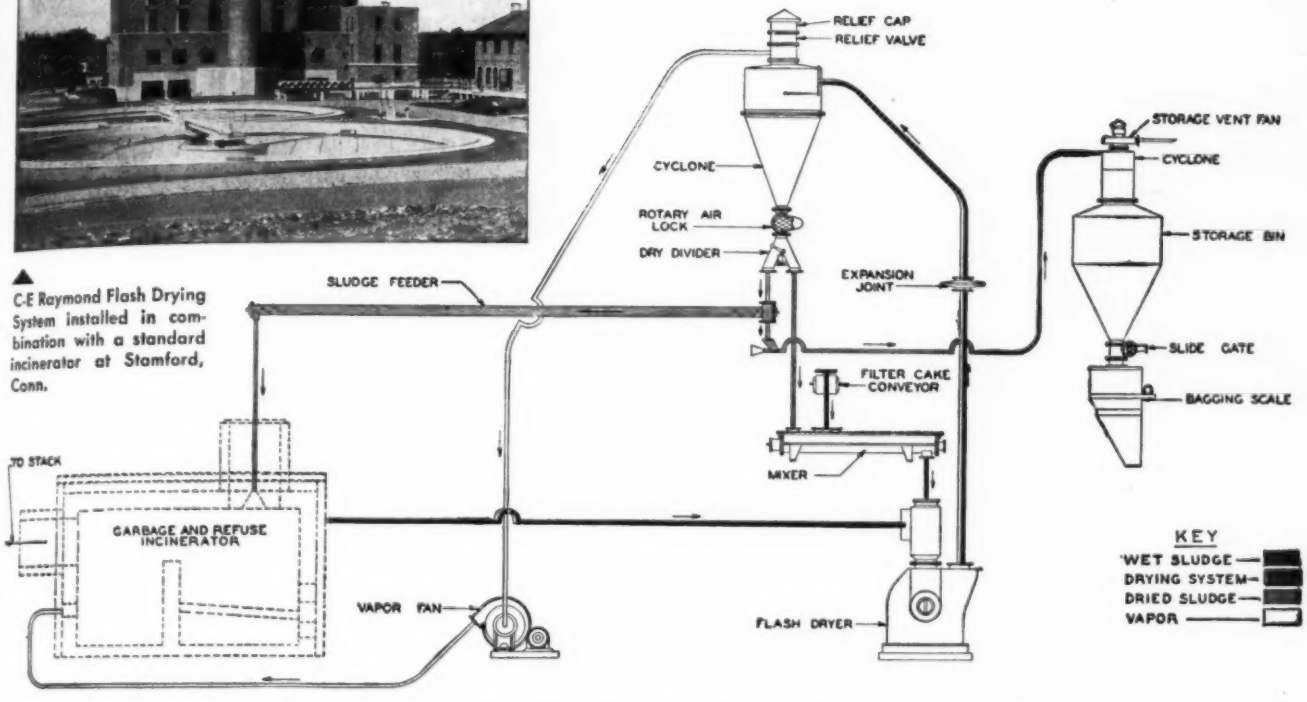

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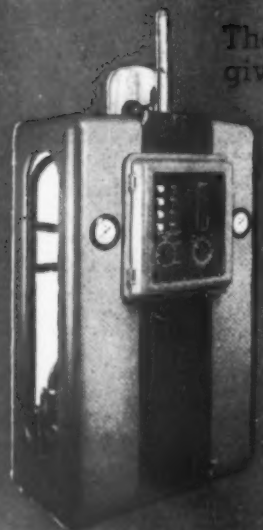

The Program Controlled Chlorinator

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